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The "Champion" Boiler for Steam Heating.

The growing popularity of heating private residences by steam has stimulated invention in the direction of providing a self-feeding, economical and safe boiler for the purpose.

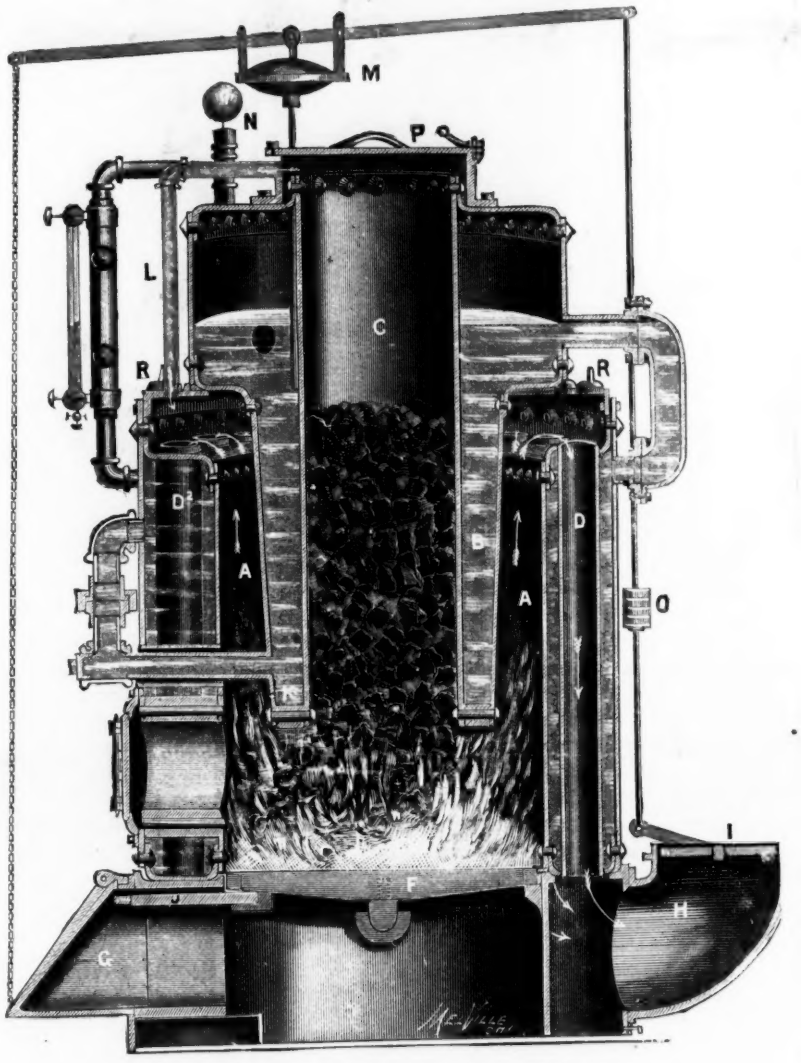
We illustrate, in elevation and section, on pages 1 and 2, a boiler especially designed for heating purposes by A. H. Fowler, Newark, Ohio.

This boiler is composed of two sections—the lower or principal section containing the fire pot, *A*, *A*, surrounded by an annular water space and the outer shell of the boiler. Passing downward through the water space is a row of return draft fire tubes, *D*, *D*, of large size. This section has the "lighting door" passing through its water space.

The upper section is composed of the steam space, the fuel magazine *C* and the water leg *B*, which latter extends around and to the bottom of the fuel magazine. This water leg serves to keep the fuel within the magazine at as low a temperature as that of boiling water, thereby preventing a premature partial combustion of the fuel in the magazine and consequent formation of gases.

This water leg also adds to the heating surface.

At the bottom of the water leg is a brass plug *K*, which can be screwed out and all the water let out when the boiler is not in use. These sections are united, as shown, by ample pipes for steam and water and to provide for circulation. All these connecting pipes are united by flanged unions, and by unscrewing a few small bolts the sections can be taken apart in a like manner, so that the boiler can be shipped in sections for easy handling, and quickly put together. The upper section rests upon a strong flanged ring, which is bolted to the upper part of the lower section, and thereby relieves all the pipe connections from strains caused by weight of boiler and water.



THE "CHAMPION" BOILER FOR STEAM HEATING.

All the spaces are caulked around this flange with hard cement, which makes the boiler gas-tight.

In this flanged ring and immediately over the top end of each of the down-draft fire tubes is an opening and stopper, *R*, *R*, which is large enough to admit of a scraper for the purpose of removing deposits from the interior of the tubes and also from the other heating surfaces

A pipe, *L*, connects the top of the magazine with the fire space, to convey any gas into the magazine that may rise from the fire when the fuel is low. The magazine is covered with a sliding door turned off true and fitted gas-tight.

The boiler is mounted on a strong cast-iron base with double walls, as shown, thus forming an annular space or chamber into which the down-draft tubes discharge their products which thence pass off at the smoke outlet *H*. This base is so constructed that all these passages are easily got at to remove ashes from grate, and also from the ends of down-draft tubes.

Provision is also made for admitting a new grate (*F*) whenever necessary. This grate is hung on a central pivot and can be shaken sideways or dumped.

G is the ash door, and also serves to regulate automatically the amount of air admitted to the grates.

The automatic controlling device connects also with the damper in the smoke outlet *H*. The door and damper open and close simultaneously, thus controlling the steam pressure. By adding to or taking from the weights at *O* this pressure can be varied at will. The direction in which the fire and heat pass is clearly shown by the arrows.

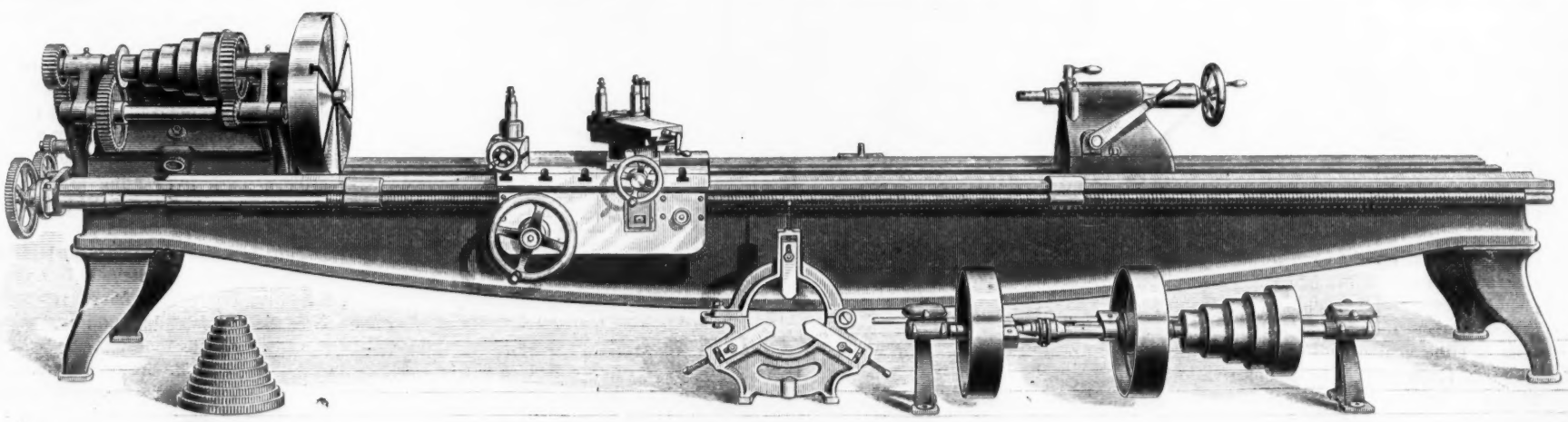
These boilers are made to safely withstand a pressure of 75 lbs., but are fitted with a dead-weight safety-valve to blow off at 10 pounds.

The boiler as shown in cut is covered with asbestos, but when desired the boilers are furnished with the necessary castings to be set in brick-work.

These boilers are made by Jas. E. Thomas, Newark, O.

Twenty-six Inch Swing Engine Lathe.

We illustrate with this a 26-inch triple-geared engine lathe, built by Grant & Bogert, Flushing, L. I. Amongst the novel features embodied in the construction of this lathe, the one most likely to attract attention is the bed, the longitudinal outline of the bottom of which, instead of being a straight line, is a semi-elliptic curve, the exact form of which is calculated with a view to best resist the tendency to deflection from its own weight, as well as from the load that may be upon it, and the action of the cutting tool. To further strengthen the bed, not only against vertical deflection, but against side thrust, the sides are cored from the bottom, so that each side, instead of being a single plate, consists of two plates, strongly tied together by cross girts cast in the core and by the solid plate, upon which are the ways, at the top. The two double sides are united across the central opening by means of a system of diagonal girts, running from one side to the other at an angle of 45°, and crossing in the center transversely, the arrangement being substantially the same as that of a lattice girder. These diagonal girts are strongly filletted immediately against the girts that connect the two sections of the sides, thus securing the advantages of solid construction with the increased strength and rigidity of sectional construction.



TWENTY-SIX INCH ENGINE LATHE.

The inner ways, upon which the headstock and tail-stock are fitted, are lower than the ways upon which the carriage slides, thus avoiding the necessity for cutting into the lower side of the carriage and thereby weakening it.

The headstock has a long bearing on the ways, but owing to the manner of gearing,

the necessary belt power is got from a cone pulley of comparatively small diameter. As will be seen, the cone and what are usually termed the back gears, are located at the front side of the headstock. The live spindle has a hole through it 1⅞ inch diameter, and is enclosed entirely from outside to outside of each bearing in a box provided with an adjustable cap. In this box are the bearings, the front one being 4 inches diameter and 7 inches long, and the back one 3¼ inches diameter and 5 inches long, fitted by lapping and scraping. The cone has five changes, and the arrangement of gearing is as follows: In the face-plate is a large annular gear, which, as well as all other gearing, is machine cut. This annular gear is made separate from the face-plate, to which it is suitably fastened. On the back end of the spindle is a spur gear. The forward end of the cone spindle is fitted with a pinion to engage with the annular gear on the face-plate, and the back end is provided with a spur wheel to engage with that on the back end of the spindle. The cone spindle is hung in a cradle, and is swung by means of the large milled nut shown on the headstock below the cone. Turning this nut in one direction throws the annular gear and the pinion into gear with each other, and turning in the opposite direction disengages these, and, continuing, engages the gears at the back end of the lathe. The cradle swings from the same center that answers in double-geared lathes to the back gears center, thus preserving correct alignment in all positions. The cradle is clamped where desired by means of the nut shown immediately over the milled actuating nut, the surfaces that are clamped in contact being turned to exact radius, so as to avoid the possibility of springing in clamping. This system of gearing gives 20 changes of speed, the slowest being 52½ revolutions of cone to one of spindle, and the others correctly graduated up to the fastest speed.

The large face-plate is the full swing of the lathe, and has six radial T slots, which are milled to size, permitting the accurate fitting of fixtures for special work. This face-plate can be removed for substituting a chuck or a small face-plate.

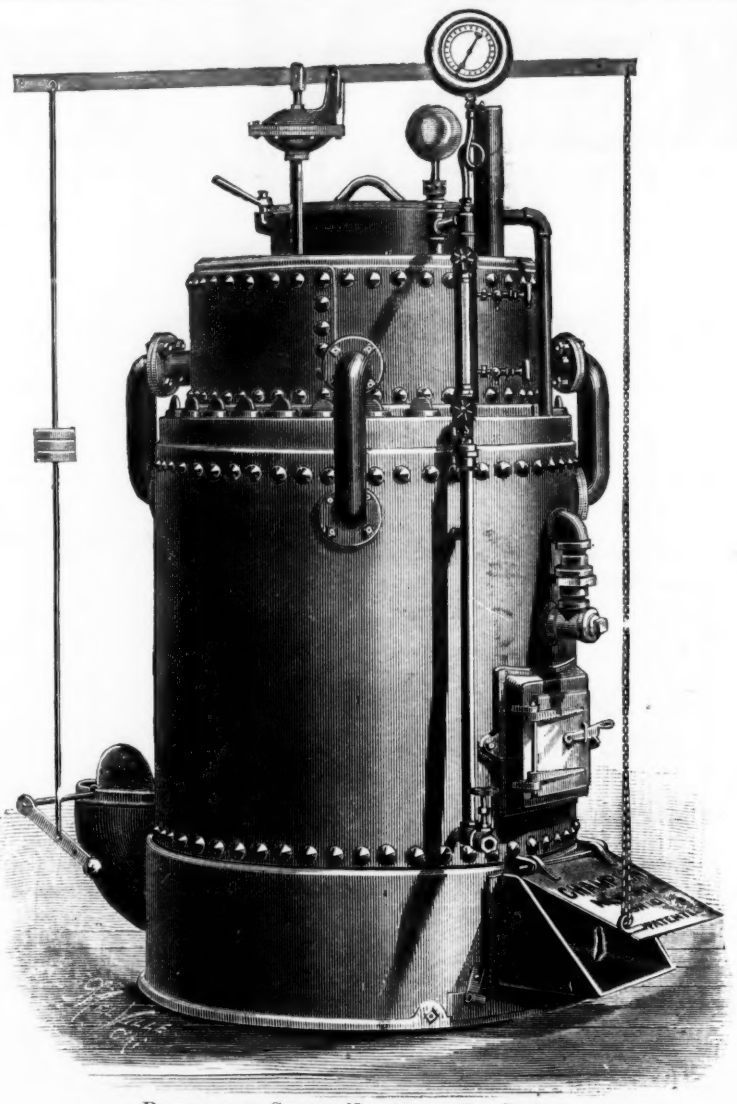
The tailstock is long, and is locked and unlocked by the action of a single lever. The tail spindle is 3½ inches diameter, and has a traverse of ten inches.

The long bearings of the carriage are fitted to the entire surface of the V's. The carriage is gibbed, and has in addition to the V bearings a flat bearing at the extreme front of bed. The T slots are milled true with the traverse of the carriage, and of uniform size, so that work can be shifted along the slots, or from one slot to the other and remain true. The compound rest has a long travel, and is locked at any desired angle (which is read from graduations) by the action of a single screw. It can be swung entirely around. The cross feed is thrown out or in by the action of a lever, and the gearing is protected from dust by a tight box. Breaking the gearing by any ordinary accident, or by neglect, is provided against.

A noticeable feature is the location of the compound rest on the carriage towards the side away from the headstock. This, it is claimed, more nearly equalizes the wear of the carriage on the ways, as much work on such a lathe is done with the tool overhanging towards the headstock; also in boring it avoids the tipping of the carriage by the tool. The compound rest is made with two slots, and provided with two tool posts. For heavy work, in turning, the two tool-posts may be used—one in each slot—and for similar work in boring or facing, the two may be used in the same slot.

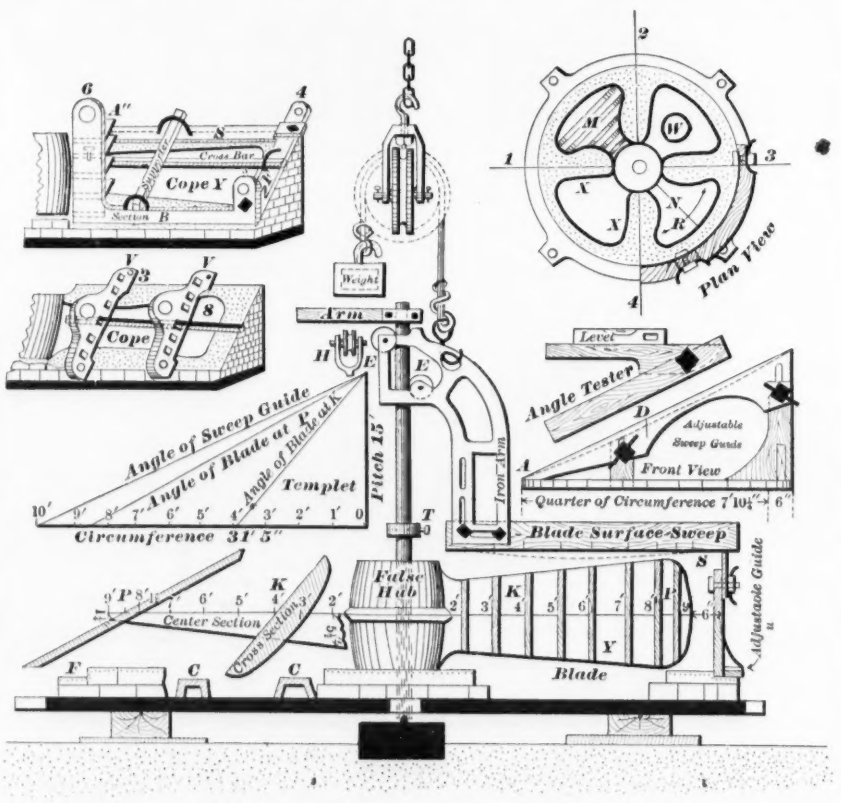
The slide for large diameters, shown at the left, may be used in any of the slots on the carriage, and can be swung at any angle for facing bevels.

The longitudinal feed is by means of the slotted lead screw, the worm traversing outside and engaging a worm wheel, no wear coming on the threads of the screw in feeding. The friction is applied through the center of the hand-wheel shaft. The reverse motion for feed is in the headstock, the



BOILER FOR STEAM HEATING.—See Page 1.

rocker gears having a bearing at each end instead of being overhung. The handle for opening and closing the half nuts for screw-cutting is at the right-hand side of apron. With the usual change gears for screw cutting, is one for cutting 11½ (gas pipe) threads. The yoke that carries the intermediate gear for screw cutting swings on the same center as that of the lead screw, and is held in the desired position by friction through the simple tightening of a single bolt. A feature of considerable novelty is employed for fastening the change gears. The end of the screw is tapered outside the position where the gear is located, and the gear is fitted in the usual manner, pins in the collar against which the hub abuts providing for driving. The end of the screw is drilled and reamed tapering for a suitable distance from the end, and beyond that the hole is continued straight and threaded. To this thread and taper a bolt is fitted. The end of the screw is split up to the collar. As will be readily understood, turning the screw back slightly will permit the gear to pass on, and turning the same distance in the opposite direction will spread the end and bind the gear fast. By the use of this the gears can be quickly changed, there being no nut or screw to remove.



MOULDING PROPELLER WHEELS IN LOAM.

The center rest will admit a piece fourteen inches in diameter, and is provided with two sets of dogs—one for small and the other for large diameters. It is fitted in the hinge so as to be kept free from lost motion. A follower rest scraped to the carriage is also furnished.

The countershaft is fitted with a friction clutch, very positive in its action, and which is adjusted with a single screw, and cannot be adjusted out of center. The oil drip is hung on a hinge, and is made with a spout, so that by removing a pin it may be swung down and emptied, but cannot fall.

We understand that this lathe is, when desired, made with double gearing and large cone on the spindle.

Moulding Propeller Wheels in Loam.

BY THOS. D. WEST.

The making of propeller wheels has, perhaps, in the devising of rigging and plans, brought about more study and thought than any other class of castings. To a man not practiced in the art of moulding, a propeller wheel, from its general crookedness, seems to present many difficulties, but to a moulder accustomed to making such wheels the job seems simple enough. What troubles loam moulders not accustomed to making wheels is to devise rigging with which to make them. Give them the rigging, and they will do the job easier than I can write an article on so crooked a subject.

The principle of a propeller wheel is that of a screw working in a nut, the water forming the nut; but while the ordinary screw working in a metal nut is a true screw, in the case of the propeller wheel it is not always a true screw, and sometimes, on account of this irregularity, it must be made from a pattern instead of being swept up.

The engravings represent making a propeller wheel 9 feet diameter and 15 feet pitch—true or regular pitch. Different plans of moulding, as well as means for determining the angle and pitch of blades, are given.

The right-angled triangle shown is for the purpose of illustrating the method of obtaining the angles of different sections of a blade. In a wheel of true pitch the angles are not the same at any two points in its length. This will be better understood by reference to the blade sections *K* and *P*. *K* shows the angle at a distance of 4 feet; and *P* at about 8½ feet in diameter. To determine the angle at any other diameter, it is only necessary to draw a line from the assumed diameter to the top of the pitch. In making a templet to obtain the angle for any desired blade, it is immaterial how large or how small the blade is. It is only requisite to have the circumference and pitch lines drawn at right angles to the same scale; then by equally dividing the circumference or base line into feet or inches, as the diameter answering to the circumference calls for, we can then get the angle at any required diameter.

In moulding propeller wheels in loam, a section, or sometimes the whole of the level bed, is first swept up. At the outer edge some will sweep a seat as shown at *F*, or in its place make the bed level, and at this point scribe a mark by passing around the bed sweep. This mark is for the purpose of setting the adjustable sweep guide, shown on the side opposite *F*. The adjustable feature is something that I believe to be an improvement over any plan I have ever seen used. After this bed is swept and divided off into as many blades as required, the false hub is swept up with bricks and loam. Around this hub a V-bead is swept, to assist in marking off the blade. After the hub is finished the hub sweep is removed, and the sweep for the surface of the blade is attached to the iron arm. Where this arm works against the spindle, two sheaves, *E*, *E*, are shown. Another view of this is shown at *H*.

So far as I know this idea of using the sheaves is original, as I have no knowledge of their being so used. It seems reasonable, however, that if used in this way there would be greater freedom of up and down movements than when there is simply a round hole through the arm.

When the blade-sweep is secured in place the sweep guide is set so that its base point *A* (in the view) is at the dividing line mark, as seen at 4 in the plan view. Or this guide

may be set by a center mark, as shown in the front view at *D*.

The blade-sweep being let down until its working edge is at the center or V-bead on the hub, the sweep-guide is moved until the center *D* is directly under the working edge of the blade-sweep, which by the way, should also radiate from the center of the spindle, this point being provided for in making the arm.

All is now ready for building the nowel brick-work, which may be done in different ways. One way would be to build up brick-work to about 1″ of the intended bottom of the mould, and then the space from this to the cope could in the thickest parts be partially filled with loam cakes to absorb the moisture from the under as well as the upper wet loam. The thinner part of the blade and joint could be made up entirely of soft loam.

Another plan is to screw a thickness sweep to the blade surface sweep, which should project below its working surface at an angle and to the distance of the thickness of the blade at its thickest section. With this sweep the loam can be swept off so as to give a bottom to build a thickness on.

Still another plan would be to make the bottom surface and thickness of all dry sand mixture. To do this the bricks should be kept about 4″ at the bottom and 12″ at the top, below the intended bottom surface of the blades. This space should then be partly filled with cinders, thus avoiding the building and drying of a large body of brick-work, besides permitting the blades to be properly vented—a very essential feature. Over these cinders the dry sand is lightly rammed and struck off to form the surface of the blades and the joint.

It is not necessary that the central portion should be built up, in building up the blade thickness in dry sand or loam. All that is necessary is to have surface enough to mark out the blade and have a solid joint.

In forming the blade a center line is struck by stopping the sweep at the center of the hub.

It may here be remarked that to prevent mistakes it would also be well, in connection with the V-bead to make a mark on the base *F*, which may be done by dropping a plumb-bob from the sweep before the building up is begun. This mark can be easily preserved, and if the V-bead is broken or the sweep moved it is left to work from.

After the center line is drawn, as shown on the plan view at *N*, the diameter of the wheel is marked by running up the sweep, to which is screwed a sharp-pointed scriber at *S*. Inside the diameter another mark, *R*, is scribed for points from which to describe the rounded corners of the blades.

After this, any number of radius lines required for laying off the width of blade at different points can be made.

In some wheels the boundaries of the blades are radial lines to the rounded corners, as shown at *X*, *X*.

To assist in getting the form of irregularly shaped blades it is well to have a thin wooden or tin frame templet made to bend to the shape of the joint, this templet being the shape of the blade and centered from the line *N*. The form of the blade is then marked off and the thickness cut out by either of the following plans:

In the first plan, which is the best for those unused to making propeller wheels, on the blade as shown at *Y*, are eight wooden gauges, each representing the thickness at different diameters, as *P* and *K*. The proper positions having been marked by the scriber, each gauge is bedded into the blade bed so as to be even with the surface. This being done the sand or loam between the gauges is taken out, and one by one the gauges are removed and the blade finished up.

In the other plan less gauges are used, the eye being depended upon for the shape; hence this plan requires practice.

After the blade has been finished the thickness is filled up with moulding sand, the surface again swept off and sleeked. The blade-sweep and guide are then removed, and the rest of the nowels or bottoms of the blades swept up.

The joint or parting being ready, the next thing is building the cope. Two plans are shown; the upper one, *Y*, will first be considered. This cope is made in three sections—*B*, *F* and *S*—held together with bolts. The section *B* has a number of projections cast on it which increase in length from the bottom up, the projection *A″* being about on a level with the top of the hub. These projections are for the purpose of supporting cross bars to carry the brick-work. The bars may be 2″ square and placed about 4½″ apart. The ends nearest the hub are tied to a supporter, to assist in lifting the hub end when the cope is lifted. The cope is lifted by the handles 2, 4 and 6.

On the section *F* are staples, one being shown with the cross-bar through it. There should be as many of these staples as the width of blade requires cross-bars. After the cross-bars are all in and firmly wedged the space is filled with loam and bricks, the brick being set endwise so as to make the thickness of cope about 9″. These bricks must be firmly laid, and the space above and below the cross-bars should be solidly filled with pieces of brick and loam. When all the bricks in the cope are laid the surface is plastered over with a coat of loam, to add to its strength and make an even surface.

In the lower cut a plan of making the cope is represented that involves less labor. In this plan, *V*, *V*, are bars about 2″ thick, 8″ wide, and long enough to lap over each side of the joint 3″

The two large holes are for passing a strong bar through to hoist the cope off. These holes are above the center, to leave the bottom the heaviest. At the bottom of these bars are two small round holes. Into these are hitched swivels, so that by adjusting them the cope can be lifted evenly. The square holes are for the insertion of cross-rods, shown at 8.

At the outer end of these cross-rods some stout wire should be wound to help in holding the brick-work. The brick-work is built the same as in the instance of the cope first mentioned.

After the copes are all built up, the joints are loam marked, and the false hub taken out. Before the copes can be lifted they must be partially or wholly dried. In some shops that are provided with proper facilities for handling and drying such a wheel, the whole would be dried at once, and when about dry it would be taken from the oven, the copes hoisted and turned up and the mould surface finished. The nowels also being finished, both parts are run into the oven and thoroughly dried, after which the mould is got ready for casting

Where such moulds cannot be hoisted with a crane, or where the oven is not large enough to take the mould in, a sheet iron curb, or in case of large moulds a temporary brick wall is built around them, and some fire-places made so that a hot steady fire can be kept up with coal or coke without the necessity of uncovering the mould, as must be done if the fire is built inside the curb or wall. Charcoal and sometimes wood is used, not only at the bottom of the mould, but top of the copes as well.

Sometimes, when oven room will permit, after the mould has been dried sufficiently to lift the copes it is uncovered, the copes lifted and finished and run into the oven to complete the drying. Then the nowels are finished, and being covered over, the fire is again started and kept up till the mould is thoroughly dried.

Another plan in making large wheels, is to build each blade on a separate plate, then after marking them they can be placed in the oven to dry. This plan involves a little more labor, but it may be more than balanced by convenience in drying.

Wheels are cast in two ways. As above described, the working side of the blade is cast up, which is objected to by some on account of the dirt. But few changes are required to cast the working side down. In casting this side down, instead of using the wooden sections, as seen at blade *Y*, to cut out the blade thickness as described they are reversed, and after being set in place a few nails are placed in the sides and end to prevent their moving. The space between them is then filled with moulding sand, which being struck off, the shape of the blade is formed, over which the cope is built. By this plan there is more certainty of the blade having its proper shape on the back, and more nearly correct shape of section. For irregularly shaped blades this plan is generally preferable. The forming of the nowal or working side of the wheel is done when this part is built by the use of the sweep shown.

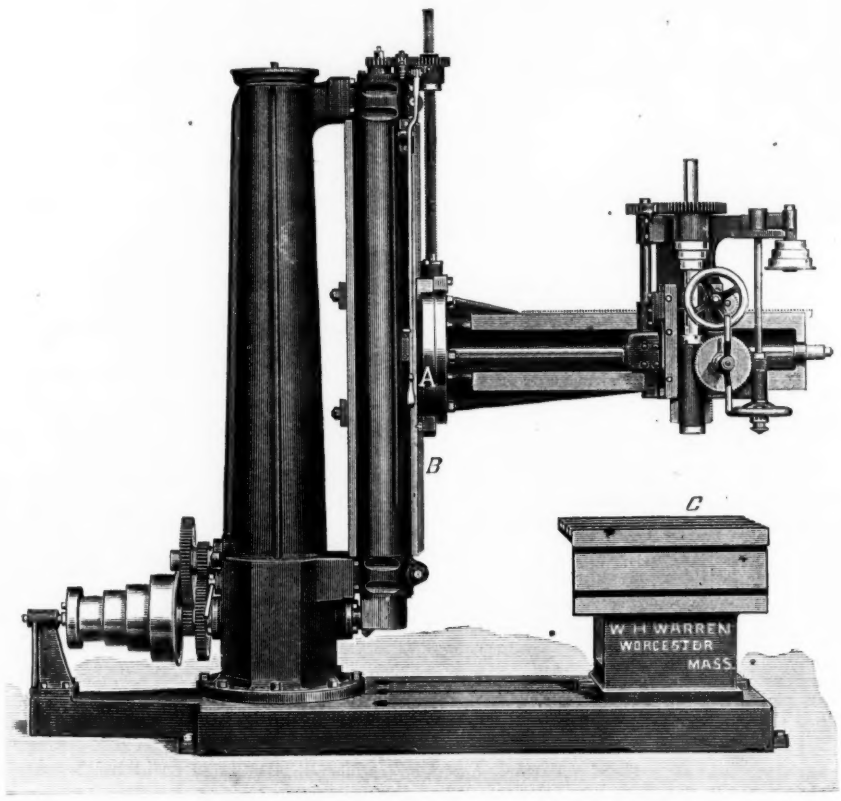
At the bottom of the blade surface sweep is shown a dotted curved line; also at the working edge of the sweep guide. These are for showing that propeller sweeping is not confined to straight lines.

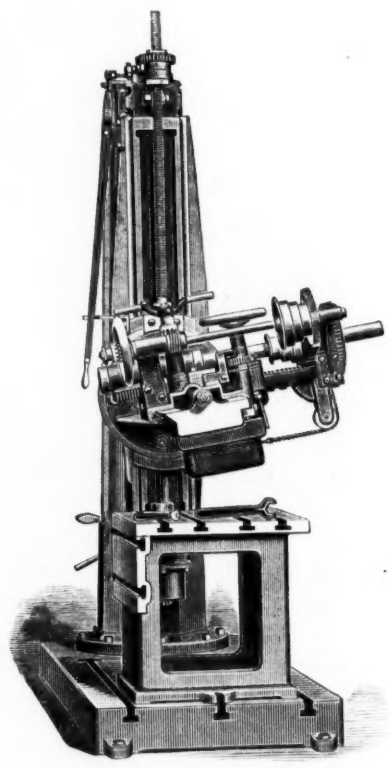
The hanging sheave, usually hung from a beam overhead, should be as nearly over the spindle as possible. It is used, as will be inferred, to be for raising and lowering the sweep when forming a blade.

The weight shown is a hollow iron box, which is weighted as required, as it is very important that the weight be accurately adjusted to the requirements.

Locomotive 169, belonging to the Philadelphia and Reading Railroad, which was illustrated in the AMERICAN MACHINIST, equipped with an indicator rig about a year ago, has just made a remarkably good run with President Arthur's train. From Somerville, N. J., to Jersey City, a distance of 35 miles, the run was made in 33 minutes, and it is claimed that one mile was made in 42 seconds by a stop-watch. If that was correct, the speed attained was upwards of 85½ miles an hour, which is pretty fast traveling.

Warren's Improved Radial Drill.





WARREN'S IMPROVED RADIAL DRILL.

The engravings presented with this, represent the recently-improved radial drill, made by W. H. Warren, Worcester, Mass. In this machine the end of providing a spindle that shall be balanced in all positions, from the vertical to the horizontal, without the necessity of making any adjustment for its accomplishment, is attained.

The spindle is raised or lowered by moving the lever handle, the mechanism being driven by worm gear and rack.

The head is moved on arm by means of a hand wheel, so arranged with rack and gears that the operator can move it quickly, having the advantage of being over his work instead of using a screw at end of arm. The arm can be turned to any degree, as it swivels on graduated shoe *A*, which is planed to the tracks on the vertical bed *B*, and secured by four bolts. The utility of having the shoe planed on the tracks is manifest when it is desired to throw the arm over and drill in a horizontal direction, as the arm can be raised or lowered to accommodate the drill and yet retain its exact position with reference to the work. The distance between bearings on vertical bed *B*, obviates the necessity of tightening and loosening the grip bolts on surface drilling, yet retaining a rigid but easy swing of arm.

The arm is raised and lowered by power, by simply working a lever.

Back gears, with large cone of four changes, give sufficient power and variety of speed. The gearing is all cut from solid metal. All shafts are of steel, with long and large bearings. All slides are scraped fits. *C* represents a portable table, which can be readiy detached and large work placed on the floor table.

An improvement has been patented by George Yellott, Townson, Md., on the hydraulic ram. It consists of an air compressing valve and air chamber, the valve operating to form an elastic cushion for the outflow valve, thereby preventing shock or jar in the operation of the ram.

The Ball Engine Company's Automatic Engine.

In the AMERICAN MACHINIST of October 21, 1882, we illustrated a novel steam-engine governor in which the resistance of the load was used as one of the governing forces. Since then the Ball Engine Company, Erie, Pa, have been engaged in perfecting the details of this governor, and in applying it to engines specially designed and constructed by them for the purpose.

We herewith illustrate one of these special engines, which has other features than the governor worthy of notice.

The frame of this engine is bored longitudinally to receive the guides, which are of the locomotive type, fitted into the bore of the frame, thus securing very perfect alignment.

The cranks are counterbalanced, and the wearing surfaces are large to admit of high rotative speed and heavy work.

A feature which is said to be important in connection with electric lighting is the ability of the governor of this engine, when desired, to increase the speed when the load increases. This is found to be a very desirable kind of regulation for electric lighting where separate engines are used for each dynamo. When so arranged the engine runs up to the standard speed only when the full number of lights are in use, and as lights are turned out the engine slows down instead of accelerating its speed, as is commonly the case. This result, it is claimed, has never before been attempted, as with all the forms of governors heretofore known a slight falling off of speed as load is added cannot in the nature of things be avoided, and to reduce this falling off to a minimum has been the aim of engine-builders.

The new force employed in this governor, it is said, makes it possible and practicable to maintain absolutely uniform speed, or when desired to accelerate the speed where load is added.

Fig. 2 shows the governor with eccentrics detached, which appear in Fig. 3. The construction is so changed from the original design as to require some explanation. The driving pulley is shown mounted on the hub of a fixed arm and carrying the weights and springs. The centrifugal force of the weights is opposed by the large springs, and the connection with the end of the fixed arm makes the effort of the engine oppose the centrifugal force also.

Thus the position of the weights at any given speed is the result of the combined force of the large springs and the effort of the engine. In this way the governor is adjusted to constantly weigh the work being done, and when the large springs hold the weights in a position to give the required speed to the unloaded engine, the resistance of the load draws them in just the necessary distance to maintain the speed desired.

Fig. 3 shows the eccentric and the mechanism which communicates from the governor weights to the eccentric. *A* is the eccentric and *B* an arm attached to its side, the outer end of which is pivoted to the fixed arm of the governor, thus allowing a pendulum motion of the eccentric the distance of the elongated shaft opening in the eccentric. *C* is a disk having a flange *D* eccentric to the shaft. *E* is a ring fitted inside this flange, and carrying the stud *F*, which stud engages with the eccentric *A*.

It will be seen that the rotating of disk *C* causes the pendulum motion of eccentric *A*, by which governing is effected. *G* is a flanged collar screwed to a sleeve projecting from the disk *C*, its office being to hold the eccentric in contact with disk *C*.

The rotating of this disk is caused by links connecting it with the governor weights. The peculiar manner of controlling the eccentric with another eccentric enables the governor to drive successfully an unbalanced valve.

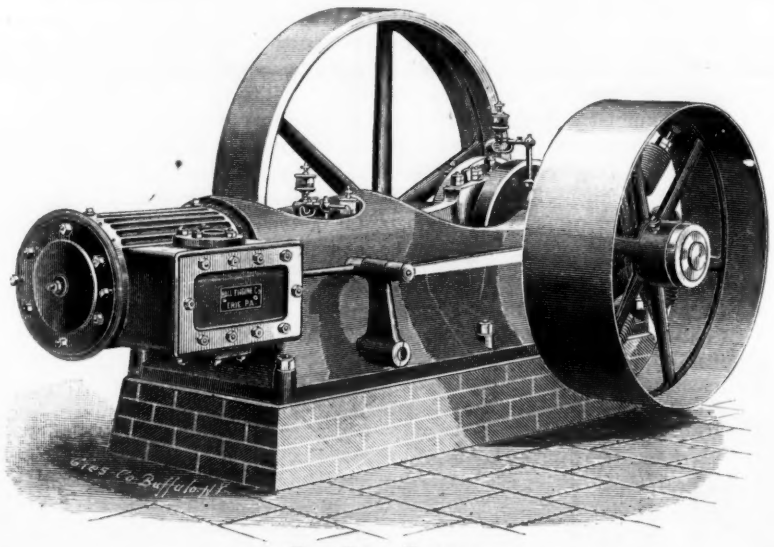
To further illustrate the performance of this engine we publish some indicator diagrams, which will be recognized as good, considering the speed of the engine.

According to the data furnished it will be seen that the loss from friction is remarkably small—the actual power realized on the break being very nearly the power exerted in the cylinder. The economy of an engine producing such diagrams is apparent and illustrates the results that may be obtained with a simple single valve engine.

These diagrams were all taken from a 9x12″ engine with a 60 spring. No. 1 is a frictional diagram with steam pressure 71 lbs. The mean effective pressure is 1.64 lb. and the horse-power 1.86

In Fig. 2 the boiler pressure was 76 lbs., the mean effective pressure 27.40 lbs., the indicated horse-power 31.23 and the net horse-power by brake 30.

In Fig. 3 the boiler pressure was 87 lbs., the mean effective pressure 47.61 lbs., the indicated horse-power 54.27 and the net horse-power by brake 50.



THE BALL ENGINE.

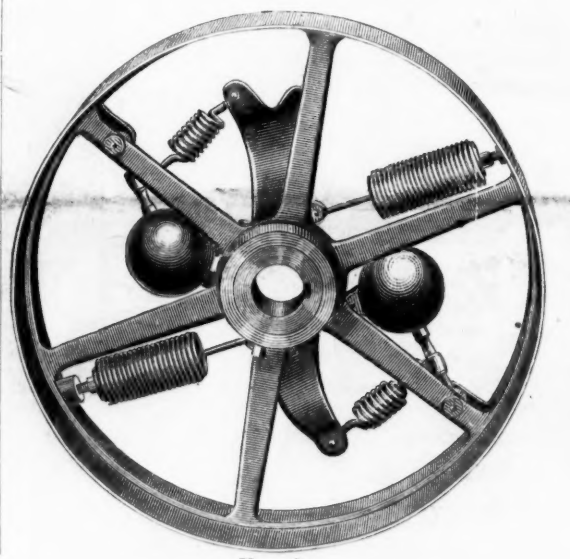


FIG. 2.

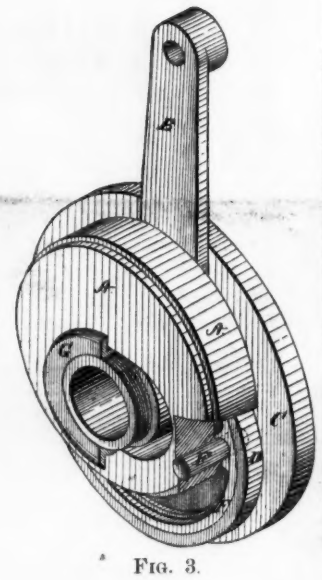


FIG. 3.

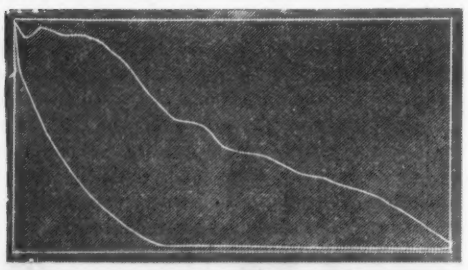


DIAGRAM 2.

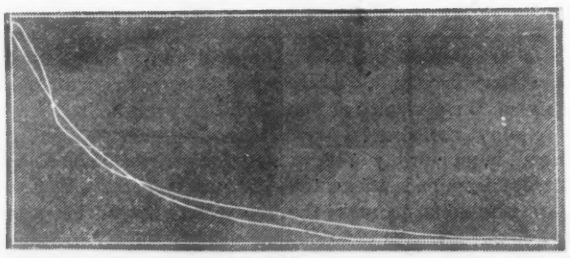


DIAGRAM 1.

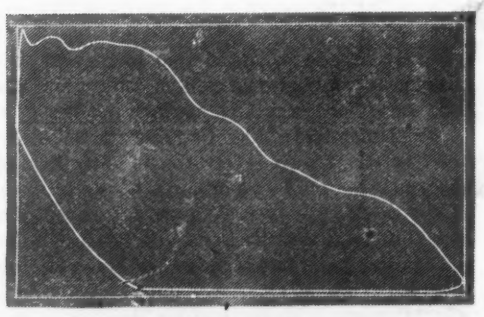


DIAGRAM 3.

A Typical British Railroad Shop.

The British Society of Engineers recently paid an official visit to the Swindon Works, the mechanical headquarters of the Great Western Railway, and considered the typical railway shops of the British Isles. In connection with this visit descriptive notes have been published which indicate that first-class English railway practice is quite antiquated when compared with the methods of our leading railroads. They appear to be away behind in the character of material handled, and their ways of getting through work would be spurned as too slow in one-horse Western railroad shops.

A steel fire-box that had been taken out of a freight engine after twenty-two months' wear attracted particular attention. It was regarded as a curiosity because few of the members had seen a steel fire-box.

The badly cracked condition of the sheets was considered proof positive that steel is not adapted for making fire-boxes. The sheets of this cracked fire-box were .43″ diameter and the flue sheet ½″. Some of the engineers had heard that steel sheets had in one instance been used on a Scotch railway with success, but the thickness of the sheets was not close to ½″.

It never dawned upon these representatives of British metal-working interests that nothing but steel is used in American practice, or that the leading cause of their uniform failures with steel sheets arose from making them too thick.

In the Swindon Works heavy slotting was being done on the slowest time by machines designed fifty years ago and that have passed along untouched by the improvements introduced in the last half century. Long holes that required to be true and straight were being drilled by the venerable flat drill, with dull edges moving round at its own deliberate speed. Nuts were being faced by fixing them on mandrels, which allowed the rough surface to work up against a true face, with the result that the faced part of the nut was not true with the tapped hole, unless the other end happened to be forged true.

If the engineers were invited to the Swindon Works with the view of advertising their perfect condition, the object seems to have been gained. The system was so perfect thirty years ago that the company has been contented to make no advance since that time.

Engine 955, belonging to the Pennsylvania Railroad Company, has been equipped for nearly a year with the Ball & Grosbeck spark arrester. This consists of a hood or deflector fitted in the extended smoke-box, which throws the sparks into a water tank provided for the purpose. The device works well, and effectually prevents the throwing of sparks. The water chamber in the smoke-box is fed by a pipe connected with the water tank, and a float indicates the depth of water in the chamber. This is necessary to prevent the water from rising to the level of the flues, when it would run back to the fire-box. There is no trouble experienced with the blast raising this water and throwing it round as might be expected. The engine steams well, and is liked by the engineer who runs her.

Stealing Car Brasses.

It would naturally be supposed that the journal brasses of a car truck are so well secured inside of the oil-box with the weight of the car resting upon them that they would be peculiarly safe from the enterprise of thieves. Yet it seems the light-fingered gentry have called mechanical appliances so well to the aid of their operations that they have been able to make a specially lucrative business out of stealing car brasses. The railroads having yards in Jersey City have experienced great trouble lately from loss of brasses, seldom a night passing without several of the cars being stripped.

A few nights ago a police sergeant made a raid in the yard of the Jersey Central and captured a man who was busy at his occupation of brass stealing. The thief was perfectly fitted out for the operations he carried on. A screw-jack, monkey-wrench, packing-hook and other conveniences of car repairing composed his kit.

This kind of thieving is particularly dangerous and annoying to railroad companies. A train is made up all ready to start in the morning, every car having passed the repairs inspector as in proper condition for the road. During the night a thief sneaks round and steals the brasses. In the morning the loss is not discovered and the train pulls out, and is fortunate if it gets to the first stopping place without having a journal cut in two and the train ditched.

A co-operative scheme has been started by the Amalgamated Association of Iron and Steel Workers in Pennsylvania. They are trying to make arrangements for

erecting a mill to be owned and operated by themselves. It is said that twenty thousand men belong to the association, and it is expected that every member will take a share of $5 value, payable in weekly installments of 25 cents.

New Pattern Makers and Machine Tools.

The engravings on this page represent some new tools built by Fay & Scott, Dexter, Me.

The 16″ pattern maker's lathe is furnished either with or without the slide-rest, shown in the engraving. The bed is made of any length desired, and is strengthened with cross-ties the same as the beds of modern engine lathes. The live spindle is provided with a screw at the back end, upon which a large face-plate can be used for turning work larger than will swing over the shears. This spindle is of steel, with bearings $1\frac{1}{16}$″ diameter and $3\frac{3}{4}$″ long.

The journals are finished by grinding, and the boxes, of hard cast iron unless otherwise ordered, are accurately scraped to fit. This spindle has a $\frac{9}{16}$″ hole through it. The cone pulley is balanced by being turned inside, and takes a $2\frac{1}{2}$″ belt.

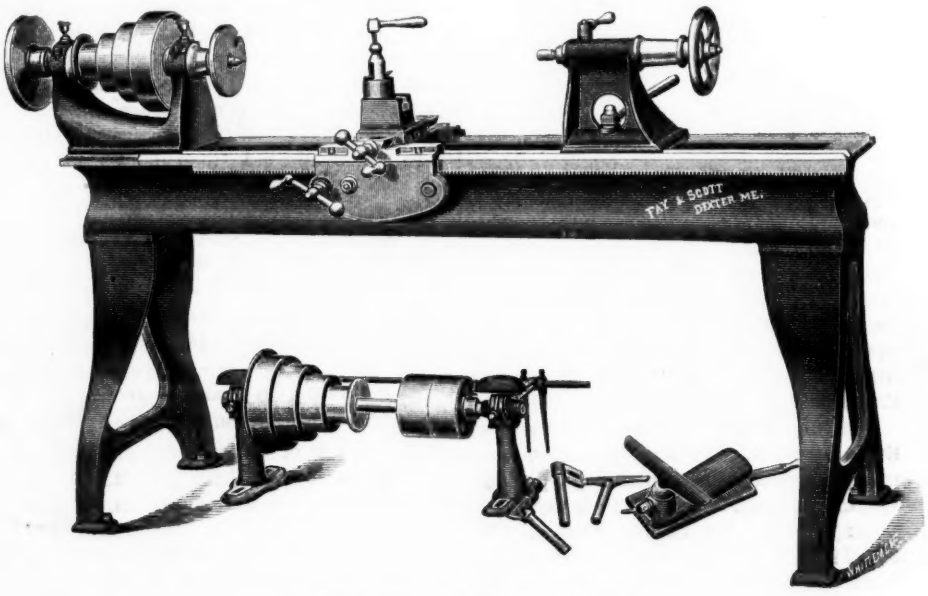
The tail-spindle, also of steel, is $1\frac{7}{16}$″ in diameter.

The bench lathe is 10″ swing, and is fitted up with the same care as the larger one, but is not made with slide-rest. This lathe is mounted on legs to stand on the floor when desired.

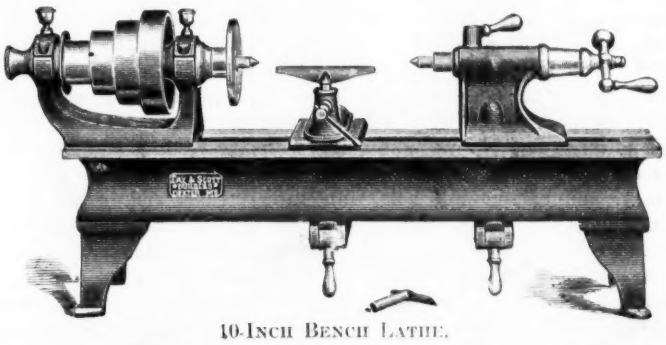
The holes in the spindles (for centers) are "Morse" taper, No. 2.

The diameters of bearings on live spindle are $1\frac{1}{4}$″ and $1\frac{7}{16}$″, the front bearing being 3″ in length. The hole through this spindle is $\frac{9}{16}$″. The cone pulley is for $1\frac{1}{2}$″ belt. The diameter of tail-spindle is $1\frac{3}{16}$″. The rest-holder furnished with these lathes rests on a plate fitted to the ways, and is readily fastened in any desired position by the operation of a cam lever.

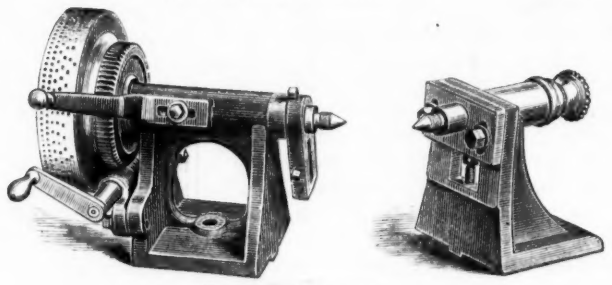
The planer centers have an index of wide range. The index is revolved by means of a gear and worm-wheel, which can be thrown out of gear by loosening one bolt. Tongues are inserted in the bottom of the head stock, which may be removed, fitted to the planer and replaced without affecting the alignment. The spindle, worm and screw are of steel. The swing of these centers is 13″.



16-INCH PATTERN MAKERS' LATHE.



10-INCH BENCH LATHE.



PLANER CENTERS.

In repairing the engines of the steamship Aurania, so that the low-pressure cylinders could be made to do the work, the ports of the high pressure cylinders were closed by rings. The high-pressure valves were left open, so that the steam might pass directly into the casing cavity, where the high-pressure cylinder exhausts in ordinary working. From this reservoir the low pressure-cylinders take the steam as they use it.

An engineer came from the firm of J. & G. Thomson, Glasgow, to look after the repairs. He reports that a new cylinder is in course of construction, and that it will be well advanced by the time the vessel arrives. They will disconnect the damaged cylinder from the others, and raise out the whole middle section, which includes the pillow that was broken by the revolving rod.

Extracts from Chordal's Letters.

SQUARE THREADED SCREWS—ERRORS IN LEAD SCREWS AND TAPS—HOW LATHESMEN FIT SCREWS TO LONG NUTS, AND THE CONSEQUENCE—A MACHINE TOOL MAN'S EXPERIENCE—PLUG TAPS AND TAPER TAPS—MANY OR FEW TEETH ON MILLING TOOLS—HAND SCRAPER AND FILE.

Mr. Editor:

* * * It has been my fortune, whether good or bad, to make a great many square threaded screws from $1\frac{1}{2}$″ to 3″ in diameter. These screws were generally for saw mill head blocks or cider presses, or something of that kind, made in quantities; and I have also had a limited experience on the finer grades of square thread screw work as found in machine tool construction.

In reciting my own experience I do it upon the presumption that it is about like the experience of most others who have had much to do with this kind of work. There are ugly features about this square thread work, and it takes a great deal less time to discover these features than to discover a means for their correction.

* * * I believe the practice in all such work is to fit the screw to the nut; a general practice, by the way, which will probably hold good in all kinds of fitting. That is, first produce the hole and then fit the internal piece to the hole. The reason is obvious; the hole is generally produced, or at least sized, by some sort of a tool like a tap or reamer.

A nut for a square thread screw is generally somewhere in the neighborhood of three diameters of the screw in length. Nuts vary, of course, from two diameters to six in length, but three will do to talk about for our present purpose.

Taps for 2″ work, three threads to the inch, are generally monstrous affairs, having not less than 18″ of cutting length. They are generally cut parallel and then tapered off outside the thread so as to gradually produce the desired depth—in fact, regular nut taps

Let such a tap as this be cut in an engine lathe geared to cut three threads to the inch, and when it is done it will contain certain errors of pitch. The lead screw of a lathe is not of the exact pitch it pretends to be, and furthermore it is not of uniform pitch. Still, we can say that this tap after it is cut is practically three threads to the inch. We temper this tap and it shrinks or expands in length, it is hard to say which, and as a consequence is not three threads to the inch. A screw properly cut in the same lathe which cut this tap cannot therefore be expected to fit in the nut produced by the tap. The trick of making these screws fit, if fit it can be called, is well understood by lathesmen The trick is simply to keep thinning the threads of the screw until it can be got into the nut; it will then have every appearance and have the feeling of a fair and perfect fit, but the fit is only on the first and last thread of the nut, and as a consequence such screws very early show lost motion by reason of the concentrated wear upon these two threads.

* * * In cider mill work this defect in square-threaded work is a trifling matter; but in machine tool work and saw-mill head block work (the latter really a very rough piece of machine construction comparatively, but at the same time requiring accuracy) the matter is very important.

* * * How to make a screw to properly fit a hole made by such a tap as I have described is a problem which has been treated scientifically more than once. One method of theorizing on the problem is as follows: A tap, say three to the inch, when it is soft, after hardening becomes something else. Find out by proper measurement what that something else is and figure up change gear for the lathe until that new pitch will be produced. It looks as though it was easy enough, but my experience is that it will be found a very difficult matter to ascertain the pitch of a tempered tap, or the pitch of a hole that it taps, even if you cut the hole open and measure it. The hole will be too short to measure accurately, and the tap will have peculiar variations in its pitch, so that its measurement is unreliable. I have put such taps in a lathe and tried change gear after change gear; even going to the trouble of making special gears, trying to make a tool follow the tapped thread nicely, but never succeeded in getting any satisfaction out of the process. I never got such a tap to run true in a lathe after tempering, and I never got a tool that filled the thread to run more than 1″ without strain. Still I have made fancy change gear which would cut a screw to fit a tapped nut a great deal better than the natural change gear would. I suppose my experience in this regard is about like everybody else's.

* * * A few weeks ago I was talking with John Grant, a man whose opinions regarding screw threads are worthy of every respect, and this subject of square thread taps came up. Mr. Grant made me feel cheap by saying that the proper way to tap these long nuts is with a tap not hardened except at the point, and not tapered except at the point. He explained this tap to me, not as a novelty in any degree, but as a contrivance well known among machine tool makers. I don't like to assume superior ignorance for myself, and therefore have thought that what Mr. Grant told to me might have a value for some others.

* * * The square thread tap, as Mr. Grant describes it, is cut parallel, and has two or three threads at the end tapered off. It is then fluted, and the flutes need not necessarily run up much past the tapered portion. The tap is then hardened at the point only. Thus a few teeth at the point are to do all the work. It will at once be seen that such a tap embodies the shrinkage or expansion due only to about an inch of its length; the untempered body of the tap acts simply as a leader, following behind, if I may use such an expression. The end teeth do the cutting, and the soft body after it gets at it, governs the pitch. It looks reasonable that such a tap should produce a nut having the pitch of the soft body, the same as produced in the lathe, and that any screw cut in the same lathe, with the same gear, will fit the nut so tapped.

* * * It will be at once seen that this method involves the tapping of a big hole, having a heavy thread, by means of a plug tap. The word "plug" may be misleading. Some machinists look upon any tap, not tapering, as a plug tap; but, for my own part, I have always been led to apply the term "plug tap" to a tap whittled off somewhat at the point to follow a tapering starting tap, and to be followed in turn by a regular bottoming tap.

Mr. Grant's square thread tap is, therefore, a genuine plug tap, as distinguished from a taper tap, a machine tap, or a bottoming tap.

I have omitted to mention that this tap is to have a long nose at its point to enter the hole and guide the tap properly; and I should also state that a complete nut is to be produced by using several of these taps—say from three to six of differing sizes at the thread.

The idea of doing heavy work with a plug tap did not at first strike me very favorably. I looked upon the long tapered body of the regular tap as the proper, and only proper, contrivance for such work. In fact, I questioned the possibility of forcing plug taps of these large sizes through a nut.

* * * Mr. Grant said that one of the great mistakes in regard to tapping was the idea that a great many teeth in a tap cutting at once, as is supposed to result from the tapering of the body of a nut tap, rendered the work easier, and he asked me squarely if I had not in my own experience noticed how easy it was to run a plug tap through a nut when compared with using a common nut tap. I had never thought of this before, but was bound to acknowledge that on those occasions, when I had violated all rule by using a plug tap in an odd nut, the job was quickly and easily performed—very much more so than when using the eternal nut tap by hand

* * * I figured up the case of a four-thread tap as follows: The thread is an eighth of an inch deep; the taper of the thread 12″ inches long, five flutes in a tap. This gives 240 cutting teeth, which follow one after another in tapping the hole, each one doing its mite. The depth of the thread to be cut is an eighth of an inch, which gives about the two-thousandth part of an inch as the depth of cut to be taken by each tooth. Mr. Grant

explained that this fine figuring showed up an inherent fault of the taper-bodied tap. If such a tap be examined after slight use, most of the teeth will be found shiny, showing that they had positively refused to take the delicate little bites figured out for them. As a consequence, they become mere rubbers, not knowing whether to cut or rub, and a few of the more earnest teeth have all the work to do under the most unfavorable circumstances. It is analogous to trying to take a very delicate water cut with a lathe tool which is not sharp. The tool will take a big cut willingly, otherwise it wants to slide. A tool may be a very sharp tool for one kind of work, and still be a very dull tool for another kind of work. The tap tooth, too dull to catch on to the 2000ths part of an inch, might take hold of a 32d of an inch with real zest. In short, the ten teeth on the end of Mr. Grant's plug tap represent ten sharp cutters able and willing to do their work. There are so few of them that they will be kept sharp.

* * * Another feature of the nut tap is this: Taking a tap of the dimensions above given in a nut 3″ long, one-quarter of the teeth of the tap are supposed to be at work at once; or in a nut 12″ long they would all be at work at once. It is very questionable whether such a tap could possibly be forced through a cast-iron nut 12″ long, but there is no doubt but what three or four plug taps could be put through, and without very hard work.

* * * The thought of the taper cut involved in the nut tap brings up other questions. Suppose we have an inch hole, and wish to make it $1\frac{1}{16}$″: we take a drill with two cutting teeth, or a blunt rose bit with twenty, and enlarge this hole with little labor upon a drill press. But if we would take a taper reamer 12″ long, 1″ in diameter at the point and $1\frac{1}{16}$″ at the butt, and try to enlarge this hole, it would be a very slow and tedious job, if the hole had any length. Any one who has fitted up connecting-rod ends having taper holes for the bolts, understands well the difficulty of removing much metal with a taper reamer. The common plan is to drill holes of different sizes and depths, and use the taper reamer to give taper and finish. If it is found that a reamer, after properly tapering the hole, has still to go an inch deeper, this reamer will be found the worst possible tool to take the metal out with. The strain upon the shank of a taper reamer, when working at its nicest, is terrible, and always risky.

* * * This brings up the question of many teeth in a milling tool or gear cutter, and leads me to revert to a case of gear cutting which I mentioned in a former letter some time ago.

Some very heavy spur gearing, 2″ pitch, 5″ face, was cut with 5″ cutters having lots of teeth, and lots of time was used. An end cutter, the shape of the space, was then tried. It averaged only an inch in diameter and had but five or six teeth, but the time consumed in doing the work was greatly reduced. The work was then done in a shaping machine, and the time was very much more reduced. I gave the figures when I first mentioned this subject. I have forgotten them now. The thing has always been a puzzle to me, and the only thing I understand about the matter is that the facts are there.

* * * The relative efficiency of many teeth in a cutter may be illustrated by a simple drilling operation. We drill a hole by means of a drill having two cutting edges in a certain length of time. Can that hole be drilled by a butt mill having many cutters in the same length of time, even provided that clearance for the chips is arranged for? I think not.

* * * On the other side of the question, take a hand scraper with its single cutting edge; will it remove as much metal in a given time as a file will? I think not. We may say that a file works over a large surface at one time, while a scraper is only cutting at one spot; but we may say the same in regard to the butt mill used as a drill.

* * * Very respectfully,

CHORDAL.

Locomotive Notes.

BY ANGUS SINCLAIR.

INJECTORS.

Injectors have made remarkably rapid strides into public favor during the last ten years. It is a safe prediction to say, that before the end of another decade, there will be no new pumps put upon locomotives. So long as injectors were imperfectly understood and were used with no regularity, they retained the name of being unreliable; but so soon as they began to be made the sole feeding medium for locomotive boilers, they had to be worked regularly and kept in order which quickly made their merits recognized.

INVENTION OF THE INJECTOR.

The feed injector was invented by Henri Giffard, an eminent French scientist and æronaut. Its successful action was discovered during a series of experiments made with the view of devising light machinery that might be used to propel balloons. Although Giffard designed the most perfect balloon that ever was constructed, the injector was not used upon it, and the invention was laid aside and almost forgotten. During the course of ase a voyage, Giffard happened to meet Stewart of the engineering firm, Sharp, Stewart & Co. of Manchester, England. In the course of a conversation on the feeding of boilers, Giffard remembered his injector and mentioned its method of action. Stewart was struck with the simplicity of the device, and undertook to bring it out in England, which he shortly afterwards did, representing the interests of the inventor so long as the original patents lasted. By his advice, Wm. Sellers & Co, of Philadelphia, were given control of the American patents.

Seldom has an invention caused so much astonishment and wild speculation among mechanics, and even among scientists as the injector did for the first few years of its use. Scientists were not long in discovering the philosophy of the injector's action, but that knowledge spread more slowly among mechanics. It was regarded as a case of perpetual motion—the means of doing work without power, or as Americans expressed it, by the same means a man could raise himself by pulling on his boot-straps.

TRYING TO FIND OUT HOW THE INJECTOR WORKED.

Among the mechanics I associated with, the injector was spoken of as a machine having a secret method of action. There was supposed to be some part inside where a vacuum was formed, which sent the water into the boiler. We were all familiar with the vacuum of condensing engines, and it was a convenient solution of the mystery. I remember committing what we regarded as a heinous sin, in trying to find out the secret of the injector. On a Sunday forenoon in a Scotch town, where it was considered next to a crime to miss going to church, three of us stole quietly into an engine house, when we knew the foreman, like a pious man, was listening to the sermon, and took an injector apart. All our plans had been laid the previous day, and the necessary tools laid conveniently at hand. The feeling of disappointment we experienced at finding nothing to explain the working of the thing, is still vivid in my memory.

THE PRINCIPLE OF THE INJECTOR'S ACTION.

The principle of the injector's action is that of induced currents, which is much more popularly understood to-day than it was twenty five years ago. A current of any kind has a tendency to induce a movement in the same direction of any body it passes over or touches. Thus, we are all familiar with the fact, that a current of air called wind, passing over the surface of a body of water sets waves in motion, and dashes the water high up on the shore above its original level. In the same way, a jet of steam moving very rapidly, when injected into a body of water under favorable conditions, imparts a portion of its motion and starts momentum sufficient to overcome the original pressure of the steam. That is how the injector is made to force water into a boiler against the same pressure the steam is starting from. The principle is now utilized in the arts for many useful purposes. The ordinary locomotive blast blowers, steam siphons, steam jets, jet exhausters, and argand burners are common instances of its application.

When the action of the injector is closely examined its mystery as a source of power disappears, for it is found that an amount of heat equal to the mechanical equivalent of work done is used up during the operation of feeding. Thus when a given quantity of heat units pass from the throttle to work the injector, the whole of the heat does not return to the boiler along with the feed-water, as was first supposed to be the case, but a portion of heat representing the foot pounds of work done is dissipated, besides other losses incident to leakage, radiation and connection.

DIFFERENT FORMS OF INJECTOR.

There are a great many different forms of

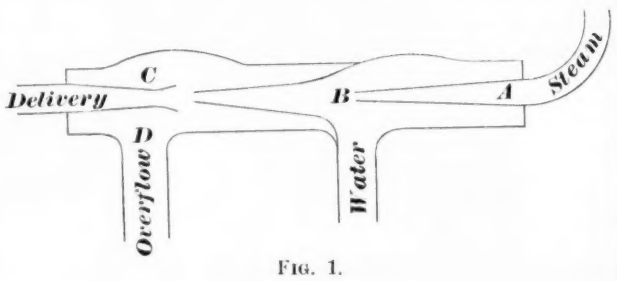


FIG. 1.

injectors in use, but all of them conform to certain elementary principles in their mode of action. Steam passes from the boiler through the steam pipe and receiving tube *A* (Fig. 1) at a high velocity, and combining with the water at the point *B* condenses, but imparts considerable momentum to the water which rushes along into the delivery pipe, raises the check valve and passes into the boiler.

The tubes of the injector are arranged so that a concentrated jet of steam shall impinge upon the water to force it through passages that are designed in the best form for maintaining the solidity of the current. The speed imparted to the water represents the work performed by the steam, and upon this velocity depends the successful action of the injector. As the current of water for starting the injector could not be induced against the constant pressure on the check valve, which equals the pressure at the throttle, an overflow is provided where the water can flow unchecked till the necessary momentum is obtained, when the overflow is closed. All deviations in construction from the elementary injector shown in Fig. 1 are made for the purpose of extending the action of the injector under varied conditions, for making it work automatically under different pressures of steam and for improving its capacity to lift water above its natural level.

A HEATER PIPE ACTING AS AN INJECTOR.

Before the invention of the injector cases occasionally happened of the heater pipe acting as an injector. Where the end of the heater pipe was carried through the feed pipe and pointed towards the check valve, starting the heater under favorable conditions would carry the water into the boiler. A great many old engineers relate instances where this has happened.

Thomas M. Drown, Secretary of the American Institute of Mining Engineers, has issued the following announcement:

"The autumn meeting of the institute will be held in Troy, N. Y., during the second week in October. This meeting will be mainly devoted to the reading and discussion of papers.

"Members who wish their papers fully discussed at the meeting can have them printed and circulated in advance, if they are sent to the secretary early in September."

A boiler feeder is patented by W. H. Knowlton, of Chicago, for carrying the feed water into a receptacle connected with the mud drum. It is well known that a large proportion of the impurities in certain waters become precipitated when they reach a certain temperature. The object of this invention is to deposit the impurities in the mud drum without letting them reach the heating surface where scale is formed.

LETTERS FROM PRACTICAL MEN.

Heating Water in a Feed-Water Heater.

Editor American Machinist:

In your reply to H. F., July 28th, 1883, you state that water cannot be heated higher than 212° Fahr. in a heater by exhaust steam. I beg leave to differ with you somewhat on that subject, as, by actual test, water has been heated, and is still heated, to 217° Fahr., and, under exceptionally good conditions, to 230°. This I can prove by good reliable authority.

You are, nevertheless, correct when you state that the water cannot be made hotter than the exhaust steam which heats it; but I will state that, in the majority of high-pressure engines, the exhaust steam leaves the cylinder at a temperature considerably above 212°. WM. PIM.

[Our answer to the question referred to was, in substance, plain, that the water could not be heated higher than the temperature due to the pressure in the heater. It is immaterial at what pressure or temperature the steam in the cylinder is at the opening of the exhaust, unless there is a pressure above atmosphere in the heater the temperature there will not be more than about 212°. If our correspondent knows of an instance where water is heated to 230° with the exhaust steam from an engine, he will find, if he will investigate, that the engine is working against a good deal of back pressure, and that the conditions, instead of being exceptionally good, are exceptionally bad.]

"Fitting up Crank Shafts."

Editor American Machinist:

The method of fitting up crank shafts, given by R. H. in the AMERICAN MACHINIST of Aug. 4th, would, at first thought, seem to be better than the one I described, and to which he refers. His description is complete, with the exception that he fails to give the resultant error.

As no one has been able to bore two holes and force the cranks on their shafts, and the crank pins in their holes without, in a majority of cases, having the two come out of truth, I see no reason why, by the plan described by R. H., they should not, in a majority of cases, come half bad.

The cause probably lies in the fact that no one has been able to make castings equally dense on all sides; and the crank pins, like animate things, lean toward the soft places.

In my own paper, very likely, I laid too much stress on the method of boring the holes in the cranks, while the point I specially wished to make was to point out a possible road to practical perfection.

Mr. Porter once told me they had never been able to put in a crank pin and have it come true, and their method of correcting the error was to pene the back end of the pin. In our practice where the method of boring the holes is, I should think, as reliable as that described by R. H., we have seldom if ever, had a pair of wheels come exactly true, and only finish the crank pins before the wheels, cranks and shafts are forced together, and for the final finishing of all other parts the setting is done from the finished pin. Without some special means for testing or multiplying errors we are, if our tools are good and our methods seem all right, likely to assume that things will come out true. But when we scrape down a piece of work to a surface plate from the best planer, or put a piece of steel in the grinding machine, when taken from the best lathe, and find how much out of truth both are, it takes a good deal of faith to assume a crank pin is right without some special means of proving it to be so. JOHN E. SWEET.

Hardening Steel.

Editor American Machinist:

I have read with a good deal of interest the recent articles in the American Machinist bearing upon the working of steel by the blacksmith, and as I have lately added, by experience, to my knowledge on this subject, I offer it in hopes it may prove of some value. It is with reference to the use of cyanide of potassium upon the best tool steel in hardening. A blacksmith who uses it freely informs me that he can harden the steel at a very low temperature when using the cyanide of potassium, that the water "bites" at the steel more readily, and that the steel springs less.

My experience is that by hardening in this way the steel will be hardened only to a slight distance from the surface, and this small amount of what is really case-hardening is very soon ground away, especially on a milling cutter or similar tool. I recently had some arbors, made from tool steel, hardened by this process, and by removing the mere skin they were found to be as soft as before hardening. In another instance a large number of pieces two inches diameter and six inches long of "Hobson's choice" steel were hardened in the same way, not one of which were found to be sprung to any appreciable extent. While standing upon the bench, after being hardened, one of them broke in two pieces with a loud report. Upon examination it was found that this expensive tool steel was not hardened to a depth of more than $\frac{1}{200}$ of an inch. For fear that the rest would follow suit in breaking, the temper was drawn to a low degree of hardness, when three of them were found cracked lengthwise. I raise the question: Is it not better to use machinery steel, since it is proved by experience that the low heat and cyanide of potassium process only hardens skin deep? I am only stating what I know when I say I have seen thousands of dollars wasted upon dies and punches by hardening at a low heat with cyanide of potassium, using an open fire.

If this process is a correct one, why not harden lathe tools by it? It is a poor rule that will not work more than one way. If first-class tool steel will not harden to a proper depth in water, or in brine, we ought to know the reason why without delay.

Another foolish thing is to expect always, to judge of the temper by the color. The application of the file test will often show the color test to be at fault. My belief is that the more times steel is annealed the less carbon it contains and the more difficult it is to harden it, and in this I am taught entirely by experience.

Mr. Goodyear says a tool for cutting hard steel should be made as hard as possible. I would like to ask if he gives any rake to the tool, or is it in the form of a scraper? Can he use a milling cutter hardened in this way? Of course I do not advise a lathe or planer tool too soft to cut the material to be worked. Some of the best steel I know of, so far as hardening is concerned, cannot be annealed so as to be worked in a lathe.

C. E. Simonds.

Stamford, Conn.

"Instructing Master Mechanics."

Editor American Machinist:

Nothing can be more "characteristic of bad taste" than the letter from "Master Mechanic" in your issue of Aug. 4th, and it deserves to be severely censured. No one should indulge in personalities in discussing the merits of a paper, such as was presented by Mr. Dean. The fact that Mr. Dean was requested to present a paper, and that it was accepted by the council, was sufficient to demand for it respectful attention, and it was enough to analyze his paper step by step, making no statement without giving a clear and logical reason for such.

The writer has known Mr. Dean for several years and has always found him to be an unassuming gentleman and one not at all disposed to "lecture the association, as if it were composed of school-boys." He is thoroughly American, and like all high-minded men, is willing to learn from all, regardless of nationality. It is perfectly evident that your correspondent is not acquainted with Mr. Dean. Were the writer so disposed, he could point many faults in the letter referred to, but he only desires to defend his friend, who knows nothing of his action.

Justice.

Boston, July 25, 1883.

Keying of Side Rods.

Editor American Machinist:

There is a great deal of talk nowadays about solid-ended rods, and other changes away from the old-established forms. The old forms have been abused as unreliable, but I believe that the greatest abuse they have received has been from engineers who hammer the brasses out of shape through ignorance of how a rod should be keyed. Take the case of side rods, for instance. When the side rod brasses have worn on the pin till they have nearly a quarter of an inch play, instead of taking them down in time and having them re-fitted, some engineers keep driving their keys, thinking that they can take up the lost motion. And they do take it up, too, but pounding the keys puts the brass into a new shape, as it appears in Fig. 1, and this is far from being an improvement on its original shape. In fact, the brasses yield at the weakest points, *E, E*, which push towards the pin, while the upper and lower bearings wedge out the strap. The severe strain bends the keys, and the strap is forced out of shape. A bad case of this kind ruins the brasses beyond repair, distorts the keys, and damages the strap.

On the other hand, brasses properly keyed retain the form shown in Fig. 2. They remain square with the strap, and the strap continues in line with the rod. When this brass needs reducing, the work to be done is easy and straightforward, saving much time and annoyance. The cases of ruined brasses from bad keying are not so very common, but they occur oftener than they ought to.

John Mahoney.

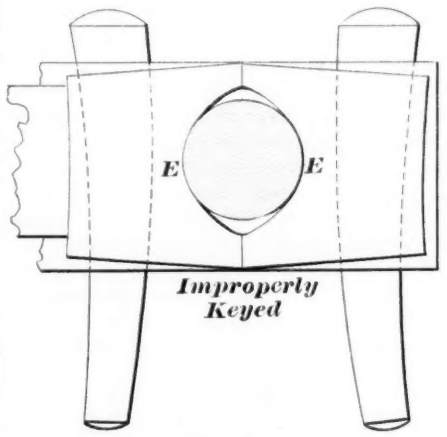


Fig. 1.

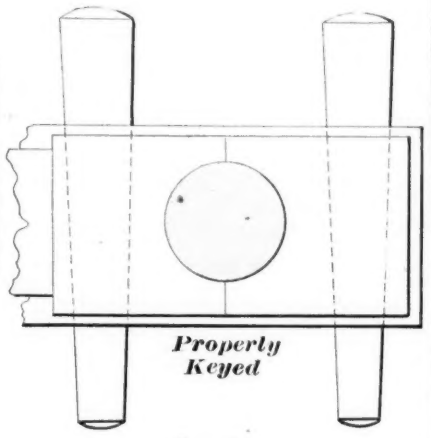


Fig. 2

Explosion of a Colliding Locomotive.

Editor American Machinist:

In the last American Machinist, referring to the collision on the N. Y. & N. E. R. R., when I read the statement that, in no previous instance has a locomotive boiler been known to blow up from this cause, I picked up my note-book and found the following record: "May 18, 1883, a wild engine on the Maine Central R. R. a few miles above Augusta, when running from sixty to seventy miles per hour, collided with a freight train consisting of twenty-nine cars. All of the cars were wrecked. The engine to the freight train exploded with terrific force, the smoke stacks landing over a hill fifty rods away. The entire boiler was carried away, many pieces being blown long distances, parts of the engine being found on the opposite bank of the Kennebec river. The concussion shook buildings over two miles away and across the river. Both engineers and one of the firemen were killed."

Mellen S. Harlow.

West Auburn, Me.

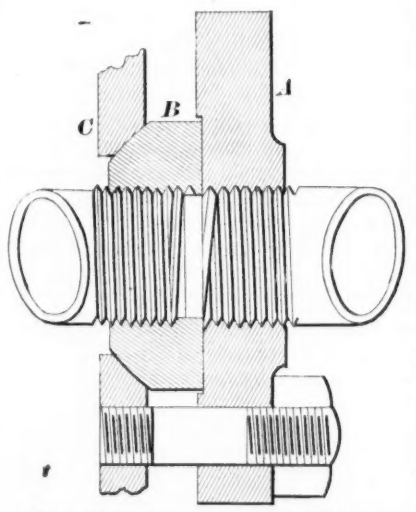
Feed-Pipe Connection to Boiler.

Editor American Machinist:

I have for some years practiced connecting feed-pipes to boilers in the manner shown in the engraving, and it is so satisfactory a plan, where it is desirable to take the feed-pipe through the boiler-head and to some point inside the boiler, that I am led to think a knowledge of it may be of some value to others.

In the engraving *C* is the head, through which a hole of suitable size is cut—preferably drilled—and reamed with a ball reamer for the bronze ball-ended piece *B*. This piece is internally threaded for the continuation of the feed-pipe inside the boiler, which may be carried to the other end and turned down to discharge under the tubes, may be perforated, or otherwise arranged. The ball is held to its seat by means of a cast-iron flange *A*, which is threaded from the outside for the feed-pipe. For 2″ feed-pipe I use three studs, usually $\frac{3}{4}$″ diameter, tapped into the head.

My experience is that a connection made in this way will never leak, can be readily taken down and put up in case of making repairs to the boiler, and can be swung in either direction so as to change the alignment of the pipe inside the boiler. This last named feature is frequently of considerable convenience, since running pipe inside a boiler is not particularly pleasant.



Feed Pipe Connection to Boiler.

One other thing about ball joints when used for a purpose similar to this:

It is generally assumed that the parts of such joints must be made with great perfection and accuracy, and that the making of a reamer is a serious matter.

A ball reamer unquestionably ought to represent a portion of a sphere, but when used for the purpose shown, it is not a matter of any great importance whether it does or does not. With the corner of the sheet smoothly chamfered the balled piece *B* will make a tight joint.

Frank Gleason.

Says the Boston *Herald:* "C. J. H. Woodbury, the inspector of the mill mutual insurance companies of this city, has had sent to him by the Société Industrielle de Mulhouse, of Alsace, Germany, its silver prize medal, in recognition of his recent work on the best means of protecting cotton and woollen mills from fire. It is believed that this is the first time that an American has been the recipient of this award."

The Use of Coke in Melting Iron.

By D. F. Treacy.*

The difficulty attending the successful use of coke for melting iron is due at different times to different causes, and it is impossible to give the remedy when one is not fully acquainted with all the circumstances. Some foundrymen experience great trouble from the iron coming dull. The difficulty in this case, I think, is generally in the first charge, and is caused by not getting coke enough on, or by putting on more iron than the bed will carry. When you consider that a bed of coal will carry 4,000 lbs. of iron, and that a bed of coke, same dimensions, will only safely carry 1,500 lbs., the change is very great, and often not fully appreciated. Still, the difficulty may come from the manner of lighting up your cupola. In lighting up a cupola using coal, we frequently use hard as well as soft wood, and it requires a considerable quantity to properly and safely ignite the coal. Such is not the case in using coke. You only require about one-half the quantity of soft wood, and no hard wood whatever.

I might mention here a circumstance that occurred at our works the second day after we began using coke. Our melter put in the same quantity of wood, hard and soft, as when preparing for coal. The furnace was lit up and ready, as he thought, for putting in the iron. He looked in the tuyeres, and, much to his surprise, saw that the wood was not yet burnt out, and we had to wait a full hour before he could put on the iron. He was going by measurement, not knowing the amount by weight, for the first bed. Had he not noticed the state of the furnace, no doubt we would have had dull iron, on the start at least. I think this is one, if not the principal reason, why many use coal on the first bed.

I find that to use just enough wood to light the coke is all that is necessary. Let us say it takes 600 lbs. of coke for the first bed; have then 150 lbs. more ready to put on immediately before charging on your iron, and then, with the proper quantity of each, I will, the furnace in other respects being all right, guarantee hot iron every time.

Another point is that we do not use at any time more than two-thirds the force of wind that we do when using coal. We have a No. 6 Sturtevant blower, which, when melting with coal, we run at about 2,200 revolutions a minute. In using coke, we do not run it more than 1,800, and the greater part of the time at between 1,200 and 1,500 revolutions. I find it is necessary to slow down the blast when nearing the end of the melt; otherwise it would be necessary to send an order to the brickyard at an early day.

It is also well to "drop the bottom" as soon as you are done pouring. By doing this you will not be troubled with any great quantity of slag, your cupola will "pick down" more easily in the morning, and the lining will last much longer.

As to having any particular kind of cupola in melting with coke, or changing from one style to another, I think it quite unnecessary. Any furnace that will melt iron with coal can be made to melt it with coke.

As to giving a formula for melting, that, of course, is hardly practicable where one is not acquainted with the style, size, etc., of the cupola. To begin right is the essential point, and to give implicit and reliable instruction in the detail of individual cases it would be necessary for one to see the furnace, or at least to be thoroughly informed in regard to all its points.

The inspectors of the Hartford Boiler Insurance Co. found 3,532 defects in boilers during May, of which 507 were dangerous.

* In my article concerning the use of coke for melting iron, published in the American Machinist of June 30th, I spoke of "Connellsville coke." I did not by this mean to convey the impression that this particular kind of coke was the only kind in the market that would melt iron. There is also another kind of coke made which we intend giving a trial at an early day.

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NEW YORK, AUGUST 18, 1883.

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Machinery Ahead of the Times.

In the development and introduction of new and improved machine shop tools and appliances, some manufacturers have become at times almost skeptical as to the ultimate success of certain efforts in this direction. The originator of a machine may assure himself by his own practical experience that it is an economical and highly desirable article for the average shop to buy, yet sometimes the mechanical public will not be attracted by the new machine in spite of diligent efforts to convince them of its advantages. The machine designer who gets ahead of the times is about as liable to lack substantial recognition (for the time being) as the one who is behind the times. The former, however, has a good prospect for the future, while the latter is bound to dwindle out of business notice.

If a really excellent machine, up to advanced shop practice, be placed upon the market unsuccessfully, shopowners refraining from purchasing it, the patterns for manufacturing should be kept in readiness for a future demand, which is likely to make itself felt in a few years, if not in a few months.

Machines and tools that would scarcely sell at all four or five years ago, are now being made and disposed of readily and advantageously, because average mechanical practice has caught up with them. Turret lathes for ordinary machine shops and special cutting-off machines were made several years ago, but the demand was until within two or three years not enough to build up a prosperous business upon. Their use, however, would have been as advantageous five years ago as now, when a good and increasing demand exists.

The use of a turret lathe in a shop doing ordinary work, with about forty hands, has been declared by those having ample experience to be just about equal to an additional mechanic, and those using cutting-off lathes wonder how they ever got along so many years without them, when those tools could have been easily procured.

The milling machine was formerly considered applicable only to shops manufacturing fire arms and special articles of that character. At the close of the Civil War the tools and appliances in armories were sold to general machine shops, and thus the merits of milling machines for a wide variety of shop-work became known. Their construction and sale for ordinary shop use soon became a recognized industry, yet the advantages of milling machines are yet far from being generally appreciated.

Centering machines are coming into use as they never have done before. Jigs for boring and facing parts of machinery were formerly almost rare enough to be curiosities. Now they form an important part of the equipment of many shops Patterns of improved machinery that would not sell some years ago, have in some instances been brought out lately and used, the product being quite salable. Thus the efforts of original mechanical enterprise, after apparent failure, have been in some instances rewarded with gratifying success.

In Cincinnati there are foundries and shops in which a bell is rung at 9 A. M. for a 10 or 15 minutes' cessation from work for what they call "lunch." The men rush out and proceed to "lunch" upon lager beer. In Cleveland a new machine shop started about two years ago which employs forty workmen. A lager beer saloon was immediately started next door to get custom from the shop. But the liquid enterprise was a failure, so far as the shop is concerned, for not one of the forty men drink spirituous or malt liquors. It is safe to say that the Cleveland shop turns out better work than the Cincinnati shops here referred to. In all probability the men are more reliable. Some years ago certain Cincinnati machine shop owners kept beer saloons on the same premises, and required their workmen to take part pay in beer checks. Temperance men were regarded as "black sheep," and were not wanted in those shops. These liquid annexes have, we believe, been discarded.

Value of Automatic Brakes for Safety.

A terrible railroad disaster happened to a train on the Rome, Watertown and Ogdensburgh Railway recently, near a small station called Carlyon. A passenger train, heavily loaded, was rushing along, pulled by two locomotives, in the midst of a raging storm. A car that had been blown out of a side track was standing on the main line, and the double-engined train smashed into it, scattering death and destruction around. Twenty-three persons were killed and a large number seriously injured. In the first place, this butchery was the result of gross carelessness in having cars so insecurely held in side tracks that they were liable to be blown out by a windstorm; and the fatality of the accident was greatly increased by the fact that the train was run without a continuous brake It is to the presence of a good automatic brake on most of our trains that railroad traveling is made tolerably safe. There is no good system of protecting trains in use, and the only hope of safety is the means of stopping promptly when an obstruction is seen. Had the engineer of this fatal train had a good automatic brake at his hand when the car was seen, the probability is that the loss of life would have been entirely avoided.

There is a growing practice in this country of running heavy passenger trains with two locomotives, and it seems to be the custom to depend upon the train engine to do the braking. As the engineer on the first locomotive has the best means of observing obstructions, it seems that he ought to have the means of controlling the stopping power. Several serious accidents have occurred this season, which were aggravated by the leading engine not having direct hold of the air brake. There is no practical obstacle in the way to carrying the air pipes to the front engine. As a measure of safety, this should be done.

A pleasure boat forty feet long, propelled by electricity, has been making successful experimental trips on the Thames. The screw is driven by a dynamo placed under the flooring of the deck, and this dynamo receives its power from a series of accumulator cells. The accumulators are capable of carrying sufficient electricity to transmit eight horse-power for ten hours. It is expected that boats of this character can be used for river service by changing the accumulators at convenient points. As the presence of a steam engine, with its objectionable accessories, is dispensed with, and more space for passengers is available, it is believed that the electric boats will be popular for pleasure parties, although the expense for motive power will be greater than with steam.

The Louisville Exhibition.

The Southern Exhibition, which was opened by President Arthur, Aug. 1, with becoming ceremonies, promises to be one of the most valuable industrial displays that the country has seen. Certainly it will have an excellent influence on Southern industries. The leading object of the exhibition is, to present the opportunity for visitors from all parts of the country to examine specimens of work and material which will show the capabilities and resources of the South. There are great tracts of the most valuable mineral lands in the Union, lying untouched in portions of the Southern States, that remain undeveloped for want of capital to provide transportation facilities. Iron ore of unexcelled quality, lies in close proximity to coal suitable for smelting. Fortunes in copper and zinc await the hand of enterprise.

Agricultural exhibits will constitute an important portion of the display, and from this section the South has hitherto drawn its principal wealth. But its agricultural products might be greatly increased by the aid of better methods of operation, by improved machinery, and by labor-saving tools. The intercourse between Northern capitalists and Southern producers, which this exhibition will afford, will, it is to be hoped, prove conducive to the interests of both parties.

There appears to be a chronic antagonism between the iron workers and the owners of iron furnaces in England, which at frequent intervals breaks into open hostilities, in the shape of a lock-out or strike. Numerous attempts have been made to reconcile the two interests and induce employers and employed to work in harmony, but without success. Recently both parties agreed to a sliding scale, which was going to regulate wages according to the market price of iron. A board composed equally of owners and workmen was formed, and both parties agreed to abide by its decision in the settling of disputes. This board was scarcely in good operation, when the iron workers of Staffordshire went out on the largest strike that has happened for years. Arbitration, as a means of settling trade disputes, appears to have received a stunning blow in the house of its friends.

An apparatus has been patented to prevent boiler explosions. This invention does not seem to be founded on the principle of keeping the aggregate steam pressure below the ultimate tensile strength of the boiler sheets. Its aim and object is, to catch some heavy gas or vapor which the inventor imagines to be present in boilers. By an arrangement of float and convey pipes, this supposititious gas is to be led harmlessly into the cylinders and forced to do useful work, instead of dealing destruction around. Its action resembles that of the pious men of the olden time, who were invested with the power of harnessing demons and hobgoblins to the plow, or of compelling them to transport the huge stones used in building churches and castles.

At the Chicago Railway Exposition there were said to be about three hundred car couplers claiming railroad patronage, and only three or four of them received any attention. Eight or ten of the patents contained the mechanical combinations necessary for a good automatic coupler, the difficulty about their introduction being that railroad companies cannot be made to adopt them. It might naturally be supposed, that this over supply of patent couplers would be calculated to discourage inventors from keeping up a crop of new patents; it does not seem to act that way. Every week brings regular additions to the list, the present week bringing forth six new candidates for disappointment.

Another monthly volume of consular reports is before us. It is dated July, 1883.

Consul Smith, at Carthagena, Colombia, gives it as his opinion that the absence of commercial travelers is more than anything else the cause of our trade with that country not being more rapidly extended. Profusely illustrated trade journals and catalogues of American goods (whether printed in Spanish or English) draw the attention of many merchants toward the United States as a better market for purchase and sale than Europe.

The Consul promises to distribute such publications when sent to him "where they will do the most good."

Consul Tanner, at Liege and Verviers, Belgium, says woolen mill operatives in those places labor 10½ hours daily and the men average 70 cents a day each, women 50 cents and children over 12 years old 30 cents. The highest wages paid to male spinners is $1 a day.

Consul Wilson, at Nantes, France, says the habits and customs of the people in that district are not favorable to the extension of manufactures. "The common people who would form the working classes in such establishments are too independent, too careless, too uncertain, and their price of labor too high to make manufacturing

profitable." He thinks the causes which have produced these habits and customs "would afford a theme for a moral philosopher and a political economist." Twenty years ago there were nineteen cotton mills in operation in Nantes, now there are but one or two or at most three, and they are of small consequence.

Consul Ballon, at Kehl, notes that in 1828 the number of people employed in cotton printing in Alsace was nearly 12,000, and they produced 21,000,000 yards, while in 1878 but a little over 6,000 were needed to produce 55,000,000 yards. Improved machinery had thus made it possible for each individual to produce nearly four times as much as formerly. The wages in Alsatian cotton mills have doubled since 1832.

Consul-General Mattson, of Calcutta, says: "The small American garden plow which turns a furrow of 8" or 9" and is so light that a 10-year-old boy can carry it on his shoulder and a good-sized pony can work it in the field, is in my judgment the very plow to introduce into India where an immense market awaits the successful manufacturer. The beam should be very high and long (much like a common wagon tongue) with a slight incline upward, so that the end could be fastened with a clevis to the yoke of a pair of bullocks. The handles should stand nearly upright.

Literary Notes.

A POCKET MANUAL FOR ENGINEERS. EDITED by John W. Hill. Published by William A. Harris, Providence, R. I.

The undoubted object of the publication of this little book, which is an enlargement of a previous and similar edition, is to advance the interests of the steam engine built by the publisher. A portion only, however, is devoted to the discussion of the engine, the remainder and larger portion containing —to quote from the Preface—"a limited number of facts, data, and formulæ" for engineers; which are, so far as they go, about the same as are found in the ordinary engineer's pocket-book.

Questions & Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(272) Apprentice, Memphis, Tenn., asks: 1. How shall I find the speed of a line or countershaft? *A.* To find the speed of any shaft, multiply the diameter of the pulley that drives that shaft by the number of revolutions it makes per minute, and divide the product by the diameter of the pulley on the driven shaft. For example, suppose an engine running 100 revolutions per minute, fully 4 feet diameter, drives a line shaft by a 3-foot pulley on that shaft; then 4 multiplied by 100 equals 400, which, divided by 3, equals 133, the speed of the line shaft. 2. Will a No 4 Sturtevant blower at 1200 revolutions blow dust 300 feet through a 10-inch pipe? *A.*—If the pipe is horizontal and straight, that speed may be sufficient. 3. Should the follower be clamped on spring packing after it is set out? *A.*—Spring packing is made so as to be just free to move when the follower is clamped tightly to the spider.

(273) J. R., Detroit, Mich., asks: 1. If a steam gauge is placed on the end of a vertical pipe, screwed into the steam dome of a boiler, will it be water or steam that moves the pointer? *A.*—It is the steam pressure that moves the pointer, but the gauge is arranged with a siphon so that water is in or in contact with the spring. 2. By placing an engine on a pair of scales, will it weigh more when making the stroke in one direction than in the other? *A.*—No. 3. How much stronger is the connecting rod of an engine when making the stroke in one direction than when making it in the other direction? *A*—If the rod is properly proportioned there is not much difference. 4. Why is the steam cut off in the low-pressure cylinder of a compound engine? *A.*—It is to promote economical use of steam. 5. If the travel of a slide valve is increased, will the point of cut-off be changed? *A.*—Yes. 6. Is the heavy side of an eccentric subject to more wear than the light side? *A.*—Yes. 7. What is best to use on a journal when babbitting the box? *A.*—It is not generally necessary to use anything. 8. What is the difference between the Stephenson and the ordinary link? *A.*—The Stephenson *is* the ordinary link.

(274) C. M. S., Leadville, Col., asks: Will you tell me how to figure the size of a cylinder for a hoisting engine to hoist 6,000 lbs., 300 feet per minute, with a drum 4 feet in diameter; also what proportioned gears to use? *A.*—The horse-power required would be $\frac{6000\times300}{33,000}=54\frac{6}{11}$, or, making allowance for friction, say 65-horse power. Your drum will be 12.56 feet circumference, and must make $300\div12.56=23\frac{8}{10}$, say 24 revolutions per minute. If you gear back 4 to 1 your engine will make $24\times4=96$ revolutions per minute. Assume the stroke to be 24 inches, the piston speed will be $96\times4=384$ feet per minute. Assuming the mean effective pressure, after overcoming the friction of the engine, to be 35 lbs. each square inch area of piston will give $\frac{380\times35}{33,000}=\frac{4}{10}$ horse power nearly, and for 65-horse power the area of piston required will be $65\div\frac{4}{10}=162\frac{1}{2}$ inches, corresponding to a diameter of about 14½ inches. If you make the cylinder 15"×24", and gear 4 to 1, you will undoubtedly be able to accomplish your purpose. There may be considerations that would make other dimensions desirable.

(275) J. M., Allegheny City, Pa., writes: I am running a Brown & Sharpe universal milling machine, and have been trying to calculate the table of diameters, pitch gears, and angles for spiral drills, but so far I have failed. The first line of table is as follows:

Pitch in inches to one turn.	Gear on worm.	1st gear on stud.	2d gear on stud.	Gear on screw.
.67	24	86	24	100

Can you give me any information in the matter? *A.*—We referred your question to the Brown & Sharpe Manufacturing Company, who courteously reply as follows:

"The table to which your correspondent refers was arranged to give all the spirals which could be produced from the gears used on the machine, and we will therefore explain how it was known that the gears named, and in the order stated, produce 67-100 inches movement to one turn or revolution of work. The worm-wheel, to which the first gear is attached, has 40 teeth. The leading screw is four thread to the inch. We multiply the 40 teeth in the worm-wheel by 24, the number of teeth in the gear on the same; this we divide by the number of teeth in the first gear on stud, which is 86. This gives us the number of turns of this gear to one turn of the worm-wheel, or 40 turns of the worm, which is 11 162-1000 turns. This we multiply by the number of teeth in the second gear on the same stud, which is 24, and divide this product by the number of teeth on screw, which is 100; this gives us as a quotient 2 678-1000, which is the number of turns the screw has made while the worm-wheel has made one turn. Now, as each turn of the screw moves the work forward ¼ inch, the 2 678-1000 turns will have moved the work that number of quarter-inches, or 67-100ths of an inch, while the worm-wheel has made one revolution."

We think, with the above explanation, and by carefully studying the principle involved, you will be able to master the subject.

Business Specials.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N.J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

James W. See, Consulting Engineer, Hamilton, O.

A. Wilkinson, expert steam engineer, Manayunk, Philadelphia, Pa.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

Consulting Engineer and Mechanical expert, C. C. Hill, 144 LaSalle street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, 25" lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Mechanical and patent drawings on short notice. W. G. Chapin, 305 Nostrand avenue, Brooklyn, N.Y.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Castings furnished for 18" and 21" swing engine lathes. Gearing turned and cut if desired. C. F. Batt, Phœnixville, Pa.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Parties desiring 18" engine lathes will find it to their advantage to correspond with James A. Fuller & Co., 3 Cyprus street, Worcester, Mass.

William J. Baldwin, consulting engineer in Steam Heating and Ventilation. Author of "Steam Heating for Buildings." Office, 96 Fulton st., New York.

Currier & Snyder, Worcester, Mass., manufacturers of improved labor-saving upright drills, 24" and 26". A specialty circular and price on application.

Young men wishing to take a mechanical course or learn the machinist's trade, call or address School of Mechanical Instruction, No. 195 Front street, Worcester, Mass.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton street, New York.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Reed's Sectional, Removable Steam Pipe and Boiler Covering. Send for circular and prices to C. C. Cowpland & Co., No. 744 Broadway, New York, agents for the States of New York and Northern New Jersey.

Business men furnished stenographers, who are machine operators, without charge for my services. Shorthand taught by mail. Caligraphs sold; special inducements offered; correspondence solicited. W. G. Chaffee, Oswego, N. Y.

Wanted—Correspondence with engine builders, boiler makers, and supply dealers in steam goods. We manufacture the *cheapest* Injectors and best Steam Jet Pumps in this country, and offer to *live men* the most liberal terms ever named. Drop postal for particulars to J. B. Sheriff, Son & Co., 68 Water St., Pittsburg, Pa.

"Useful Information for Steam Users"—a 100-page illustrated pamphlet, carefully compiled from the best authorities, on the care and management of the steam engine and boiler, with hints for engineers and firemen. Engineers everywhere should have this work. Send 25 cents in P. O. stamps for a copy. The J. N. Mills Publishing Co., 145 Broadway, New York.

The "Lancaster" new patent tools, viz., Screw Plates; Pipe Cutters, with and without Burr Scrapers; Wrenches; Pipe inside Burr Reamers; Drill Chucks; Combined Punch, Shears, Anvil, and Rod Cutters, &c.; all newly designed and highly efficient. For agencies, illustrated circulars, and liberal discounts, apply to Lancaster Mfg. Co., 36 Dey st., N.Y.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST: with a steel portrait of the author, and upwards of fifty original illustrations by Chas. J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

Credits.—Ealy's "Blue Book," July, 1883, just published, contains a complete classified list of over 100,000 names of machinists and dealers in machinery, railway machinists, engine and boiler makers' supplies, brass goods, metal, etc., in United States and Canada. The book is condensed making it much more convenient to handle than a larger agency book. It gives the financial standing and paying qualities of all dealers and manufacturers in the above-mentioned lines of trade. For terms, etc., address The John W. Ealy Company, 51 Chambers street, New York, or 79 Dearborn st., Chicago, Ill.

Manufactures.

The American Plow Company, Ayr, Canada, has been organized with a capital of $100,000.

A company is about to organize in Mankato, Minn., for the purpose of making iron fence-posts for ordinary use.

The firm of Miles, Ross & Vandervoort have decided to locate their works for the manufacture of Little Giant fire engines at Bloomington, Ill.

J. A. Fuller & Co., Worcester, Mass., have added to their business the manufacture of small planers, and also 8" and 12" speed lathes from new designs.

A barrel manufactory is to be built at Charleston, S. C., the Standard Manufacturing Company of that city having purchased seven acres of land for the purpose.

The Cleveland (O.) Forge and Iron Company have just placed in their shops a sixty-foot lathe with sixty-inch swing, made by Thomas Shanks & Co., Johnstone, near Glasgow, Scotland.

The Barnes Manufacturing Company, Freeport, Ill., have purchased the shops of two other establishments, and will use them to increase their production of agricultural implements.

The Gilbert Car Manufacturing Company, Troy, N. Y., have received an order for two palace cars from the government of New South Wales. They will be used on the line from Sidney to Melbourne.

Malleable iron works are to be started in Keokuk, Iowa, at an early day. Ground has been purchased and preparations are going forward toward the erection of a foundry, 25x30 feet, and a finishing-shop 25x40 feet.—*Industrial World.*

The Dean Brothers Steam Pump Works, Indianapolis, Ind., have recently shipped two large double-plunger mining pumps to coal mines in Alabama, and have also furnished a large pump for the water supply of the Iowa Penitentiary.

Two old manufacturing firms of South Pueblo, Col., have joined partnership under the name of the Colorado Machinery Company. The shops are in South Pueblo, and the intention is to go largely into the production of mining and other machinery.

The St. Louis, Mo., Foundry Company are building a new addition to their works, 100x30 feet, to be used as a stock-house. As soon as this building is completed the company will begin the erection of another, to be used as a cleaning and polishing department.

Nichols & Co., manufacturers of engines and mining machinery, of Denver, Col., have engaged to manufacture the Sharpneck Steam Stamp, a recent invention which is well spoken of. They are erecting new works, and expect to carry on business on a large scale directly.

The Ball Engine Company, Erie, Pa., inform us that their new automatic engine is meeting with ready sale. One of them will be on exhibition at the fair of the Manufacturers' and Mechanics' Institute, at Boston, this fall, where it will be used for the Fuller electric lights.

The Worcester Malleable Iron Company have nearly completed the erection of large and commodious buildings for carrying on their business. Among the plant, which is well arranged and of the most approved kinds, there is one of B. W. Payne & Sons' horizontal engines, made at Corning, N. Y.

The Albany Agricultural Company, Albany, N. Y., will increase its facilities and improve its works. To this end it is to be reorganized as the Hudson River Agricultural Company, capital $250,000, almost all of which has been subscribed. New shops have been erected, and when completely equipped, they will employ about five hundred hands.

The property and interests of the Boston Machine Company, Boston, Mass., which has been in the hands of assignees since last May, has been bought by Nash, Spaulding & Co., who will retain the skilled workmen who have long served this company, and carry on the business under the title of the Boston Machine Company. The capital stock will be about $200,000, and paper machinery and castings for water works will be the specialties.

Walter Scott, the inventor of the Scott printing machine, has issued a circular saying: "As it has been currently reported that I am about to withdraw from the manufacture of printing machinery, I beg to state that the report is incorrect. I am going to erect large and commodious shops, and thoroughly equip them with the very best machine tools extant for the manufacture of printing presses and will shortly be able to offer to the public a full line of these machines, and shall make a specialty of web perfecting machines, to print from type or plates, lithographic, stop-cylinder, two-revolution, and drum-cylinder printing presses."

The Portsmouth Machine Company, Portsmouth, N. H., the former firm of Critchley & Whalley being the prime movers, have bought out the partly burned buildings formerly used for a cotton factory in that place, and are rebuilding and altering into a first-class machine shop. The main building is 200x70 feet, two stories high. The outbuildings will be utilized for foundry, annealing and other purposes. The Eastern Railroad passes by the door, giving good railroad connections. The company manufacture Critchley & Whalley's former specialties, and do a general machine business. They have ordered a 14" lathe of Grant & Bogert, Flushing, N. Y., and a large lathe of the Pond Machine Tool Company, Worcester, Mass., and will need a good many other tools.

Hewes & Phillips' Iron Works, Newark, N. J., have several very heavy specimens of the machines they build under construction. An immense slotting machine, weighing over 40 tons, is about completed for the Miller Forge and Iron Company, Pittsburgh, Pa. There is a planer of 45 tons' weight well under way for the Oregon Iron and Steel Company, Oregon. Several of their Standard Allen engines are in various degrees towards completion, one for the Eden Paper Mills being almost ready for shipment. A great deal of care and labor is devoted in these works to giving bearing surfaces accuracy. Ground journals and hardened pins are a regular feature of their work. But all other than bearing surfaces are painted, no polished finish being made for ornament alone.

An interesting sight in the works of Watts, Campbell & Co., Newark, N. J., is the large pulley, 26 feet diameter by 9½ feet face, and weighing 82 tons, which is set up on the boring mill to be bored for the shaft. This shaft is 19" diameter, and transmits the power from two 32x60 Corliss engines that will be used for driving the machinery of the Clark Thread Mills, of East Newark. In addition to these engines, the same firm has two engines, 24x56, ready for shipment to Lake Superior, where they will be used for hoisting engines in a large mining establishment. In looking around these works, one is struck with the peculiar excellence of the castings produced. Those large Corliss cylinders, with all their complex coring, come out without flaw or blow hole. The huge segments of the 82-ton pulley show no indications of twist or porous spot. This firm contemplate making several important changes on their works shortly, which will help to facilitate finishing and shipping heavy material.

The A. S. Cameron Pump Works, at the foot of Twenty-third street, New York, are making several important alterations in the arrangements of the shops, to give greater convenience in the handling of material. Ten pumps of their largest size, which belong to one order, are almost ready for shipment, and business in all departments of their work is fair, but not rushing. Among the stock we observed several pumps made entirely of a specially prepared brass, which is mixed with a view of making it withstand the corroding action of water highly charged with sulphur compounds. In many cases the corroding power of water in mines is so great that it will eat through iron castings in a few months. Brass that contains zinc corrodes badly also, so Cameron's people use only tin and copper in making their pump brass. To make the metal run, phosphorated tin, a German preparation, costing 55 cents a pound, is used. The castings made by this process show a beautifully dense grain, and are entirely free from porosity.

Machinists' Supplies and Iron.

NEW YORK, August 2, 1883.

In supplies business is quiet, as may be expected at this season of the year.

The Bridgeport Machine Tool Works, 14 Dey street, New York, have issued a new illustrated catalogue of machine tools, which, in addition to the usual commercial information, contains an illustrated history of the New York and Brooklyn Bridge, from its conception to its completion.

Kearney & Foot, 101 Chambers street, New York, have issued a new price list of files, intended to supersede the "Stubs" and "Grobet" cuts and shapes. This list includes several grades of finer cuts than any previous list issued, and is very complete in shapes.

In iron the demand is light, but there is no very material change in prices. We quote American No. 1 X Foundry, $22 to $22.50, with special brands, in some instances, $23 and $23.50; No. 2 X sells at $19.50 to $20.50. In Scotch Pig quotations are: Coltness, $23.75 to $24; Glengarnock, $22 to $22.50; Gartsherrie, $23.50; Summerlee, $23 to $23 50; and Eglinton, $21 to $21.50.

Antimony—asking prices—Hallett's, 9¾c.; Cookson's, 10¾c., with transactions at slightly lower figures.

Copper, in ingots, Lake, 15¼c.; other brands 14c. to 14¼c.

Tin—Banca scarce, and held at 25c.; Straits 21⅜c. to 21½c.

Spelter—Refined, 8c. to 8¾c.; Silesian, 5c. to 5¼c.

Lead rules dull, with prices at 4.30 to 4.35c., and few buyers.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue

Wanted—A first-class pattern maker. Steady work to right man. Address, Birmingham Iron Works, Birmingham, Ala.

Mechanical draughtsman desires engagement. Six years' practical experience; technical education; age 25; good references. Address, W. H., AMERICAN MACHINIST.

Wanted—Two hands to build planers and other tools. Must be first-class, and understand scraping, fitting, and setting up. Address Detrick & Harvey, Baltimore, Md.

Wanted—A first-class foundry foreman. Must be a good workman. To the right man it will be a steady job. Four dollars a day at first, and more as he makes the foundry profitable. Address, Birmingham Iron Works, Birmingham, Ala.

Wanted—One or two good tool makers. Only experienced men (who understand the importance of close fitting, and *can do it*) need apply. State wages and give reference.—Trump Bros. Machine Company, Wilmington, Delaware.

Wanted situation as assistant draughtsman in some first-class engine works. Several years' experience in drawing. Shop experience and theoretical education. Address Mechanical Draughtsman, 136 Lake street, Cleveland, Ohio.

An Eastern man, with ten years' experience as foreman and superintendent in the manufacture of Wood-Working, Woolen, and Printing Machinery, would like a position. Parties building machinery, who would like to adopt the apprentice system on a large scale, would find it for their interest to answer this. Address B, care AMERICAN MACHINIST.

Light and fine interchangeable machinery to order. Foot and power lathes; slide rests, &c. Catalogue for stamp. Edwd. O. Chase, Newark, N. J.

Wanted—A partner with about $5,000, in a small machine shop and foundry within 10 miles of New York. A mechanic preferred. Address, Box 2, AM. MACHINIST.

Wanted—A partner; a practical machinist, moulder, or draughtsman, with $1,500 or $2,000 capital to invest in a good paying business. Correspondence solicited. Address Larry B. Harris, Rushville, Ind.

For immediate delivery, 16″, 18″, 25″ and 26″ swing engine lathes from new patterns, combining all the best improvements, at exceedingly low prices. For cuts and prices, address J. B. Reed, Cairo, Ill.

For Sale—Foundry, machine and blacksmith shops in the most live town in Southwest Iowa Good shipping to Kansas, Nebraska and Missouri. Manufacture steam engines, house and railroad castings. Only small capital needed. Terms easy. Address, Iowa, care AM. MACHINIST.

The Soho Foundry and Machine Works, Toronto, Canada, for sale. These works, which are the best located in Toronto, being just opposite the Union Station and not 100 feet from the water, offer a rare opportunity for any manufacturer desirous of doing business in Canada. For full information apply to Geo. F. Bostwick, Trustee.

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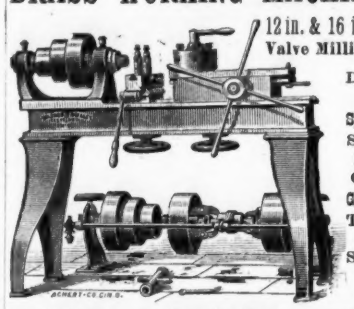
189 & 191 Front Street, New York,
MANUFACTURERS OF
Machinery, Engine, Cylinder, and Tempering
OILS
Samples Submitted Free. Established 1822.

BRASS WORKING MACHINERY.



12 in. & 16 in. Monitors
Valve Milling Mach's
Double Key Lathes,
Speed Lathes
Slide Rests
Revolving Chucks for Globe Valves,
Two-Jawe Chucks,
Small Tools and Fixtures.
WARNER & SWASEY, Cleveland, O.

COOKE & CO., DEALERS IN
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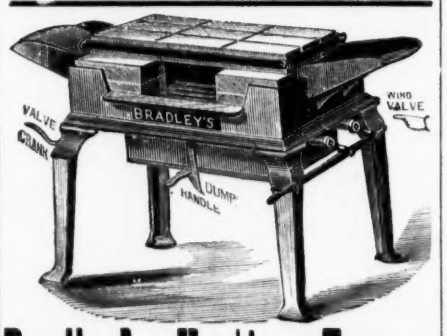
AGENTS FOR

The Waters Perfect Governor.
Having Adjustable Speed, Automatic Safety Stop, Sawyer's Lever, and Solid Composition Valves and Seats. Also
SUPPLIES
For Machinists, Railways, Mills, Mines, &c.
Please send for circular and state that you saw the advertisement in this paper.

A. F. CUSHMAN MANUFACTURER OF **CHUCKS** HARTFORD, CONN. U.S.A.
All Sizes, Independent, 4-Jaw Combination Universal Geared and Lever. Brass Finishers' 3-Jaw, from 4 in. to 9 in. Chucks for Cutting-off Lathes, Screw Machines, and Amateur Lathes. Centering and Drill Chucks.
SEND FOR CATALOGUE.

TO LEASE—WATER FRONT, MILE and a half in extent, docked and ready for immediate use; within twenty miles of New York City, on Long Island Sound, having railroad as well as water communication. Manufacturers and others needing much or little room can have suitable accommodation, with long lease, at nominal rent. The introduction of manufacturing interests upon the property the primary object of the owners.
Further particulars can be had on application to the agents, RULAND & WHITING, 5 Beekman st., New York.

W. C. YOUNG & CO., Worcester, Mass.
Manufacturers of
ENGINE LATHES, HAND LATHES,
Foot Power Lathes. Slide Rests, &c.



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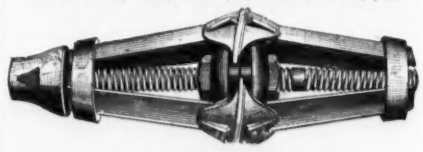
FOR HARD COAL OR COKE,
BRADLEY & CO., - Syracuse, N. Y.

E. G. FELTHOUSEN, BUFFALO, N. Y.
Manufacturer of
Patent Flue Scrapers
Ratchet Drills, Gauge Cocks, Cylinder Oil Pumps, &c.



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Best and Cheapest Flue Scraper made.
C. M. MORSE, Eastern Agent,
Office, 12 CORTLANDT ST., N. Y.

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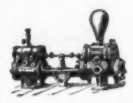
GEO. F. BLAKE MANUF'G CO.
HAVE REMOVED TO THEIR NEW QUARTERS,
95 & 97 LIBERTY STREET, N. Y.



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HOLYOKE, MASS.
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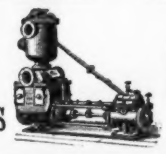

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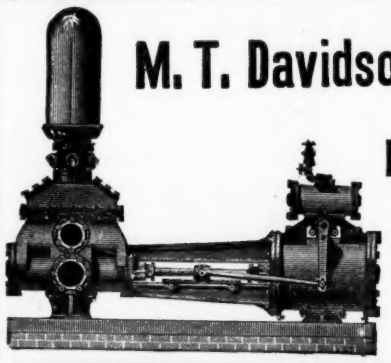
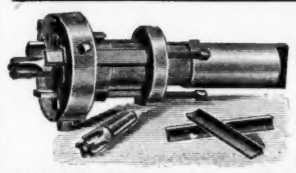
STEAM PUMPING MACHINERY
For Every Possible Duty.

UNION STONE COMPANY,
Patentees and Manufacturers OF THE
UNION EMERY WHEEL.
EMERY, EMERY WHEEL MACHINERY AND TOOLS A SPECIALTY.
Automatic Knife Grinding Machines, Wood Polishing Wheels, Grinders' and Polishers' Supplies.
Catalogues on application. 38 AND 40 HAWLEY STREET, BOSTON, MASS.

THE
M. T. Davidson Improved Steam Pump,
MANUFACTURED BY
DAVIDSON STEAM PUMP CO.,
OFFICE AND WORKS,
41 to 47 KEAP ST., BROOKLYN, N. Y.
Warranted the Best Pump made for all situations.
KELLY & LUDWIG, AGENTS,
49 and 51 North Seventh Street, Philadelphia





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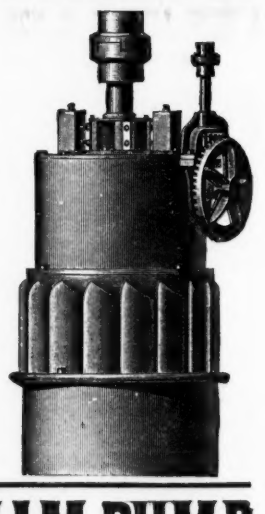
THE HERCULES TURBINE
Gives more power for the same size, also better average results from full to one-half gate than any other water wheel ever made. It is moderate in cost, compact in form, and not liable to get out of order.
—BUILT BY—
THE HOLYOKE MACHINE CO.
SHOPS AT
Holyoke and Worcester, Mass.
Send for Catalogue, Circulars and Price List to either of the above places.



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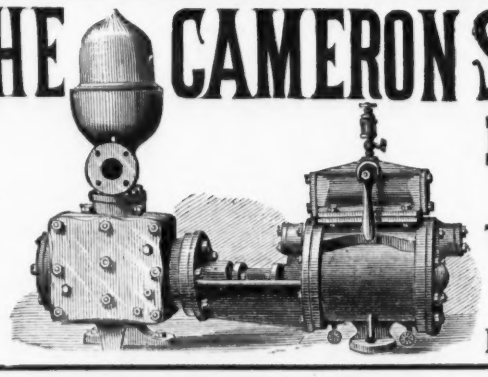

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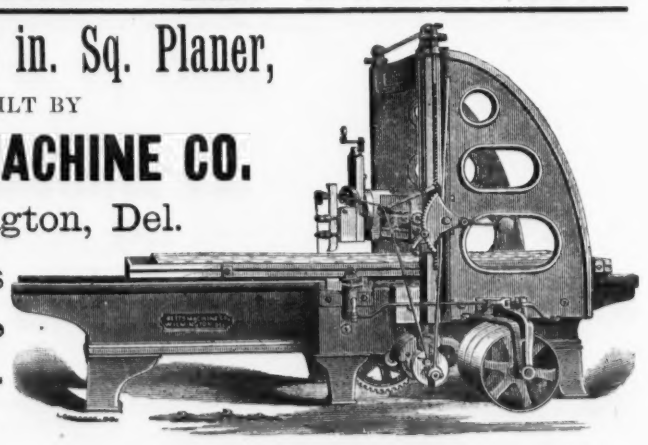

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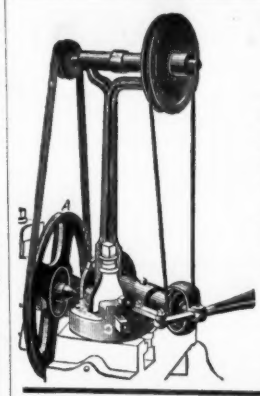

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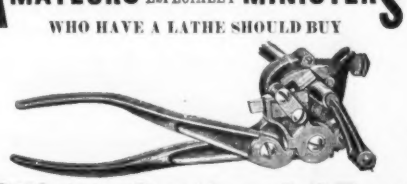

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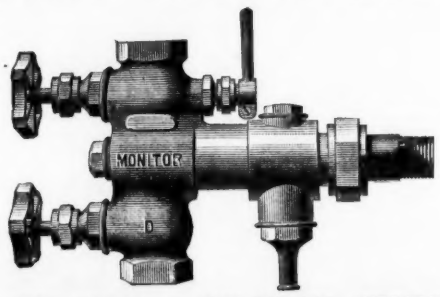

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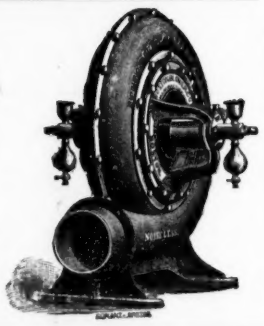

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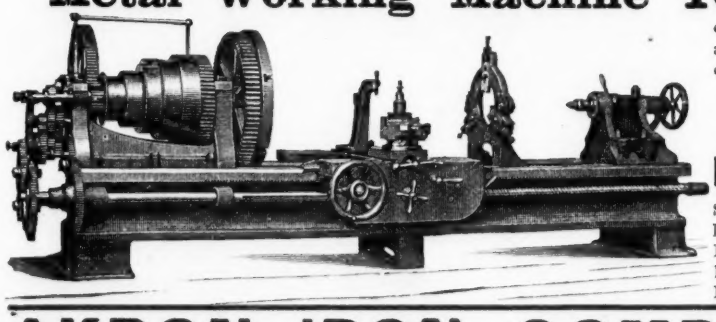

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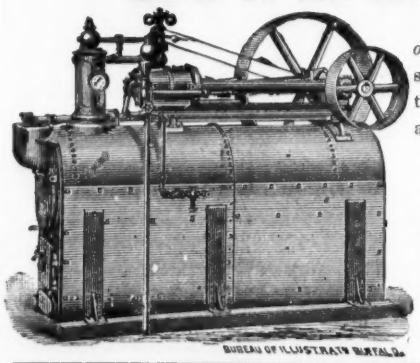

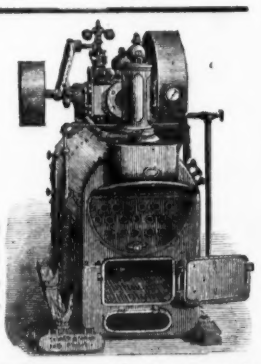

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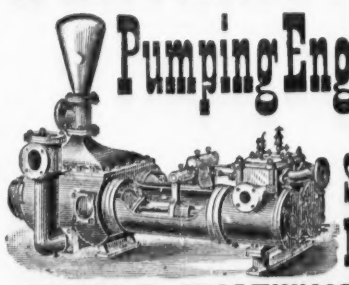

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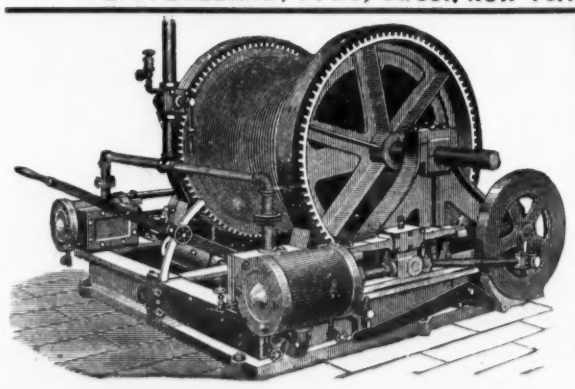

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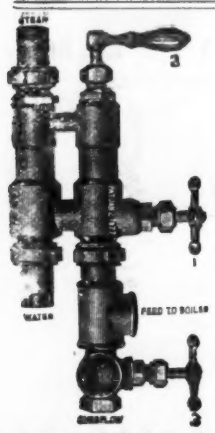

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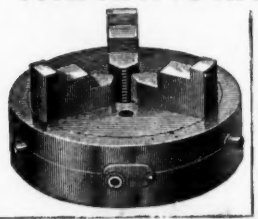

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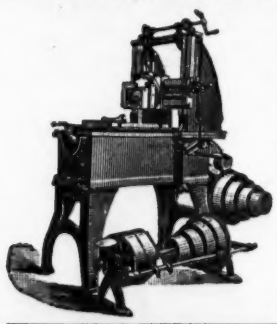

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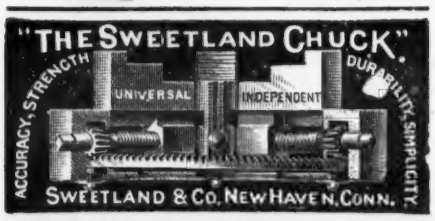

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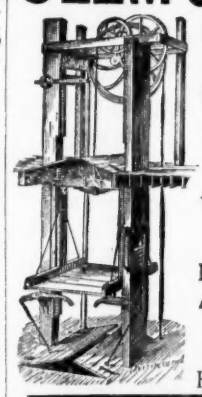

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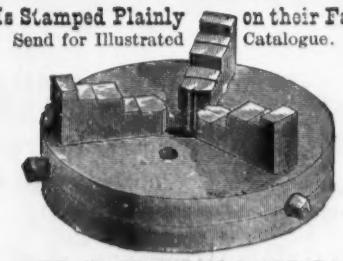

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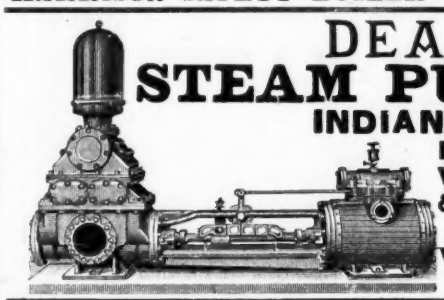

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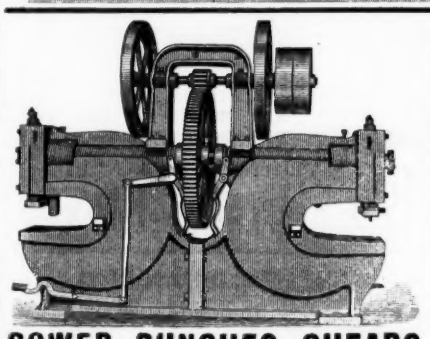

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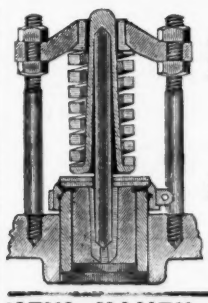

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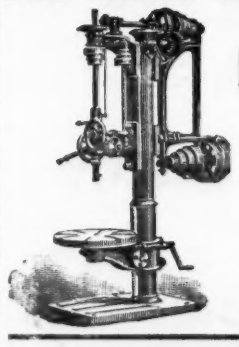

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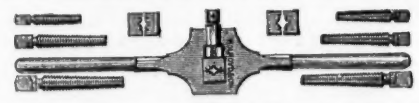

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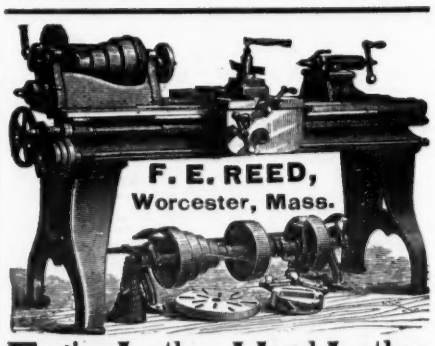

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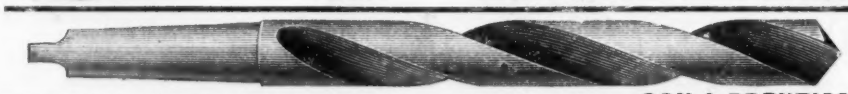

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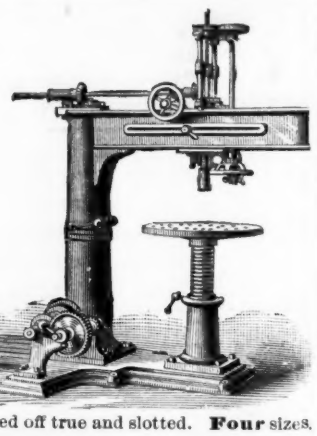

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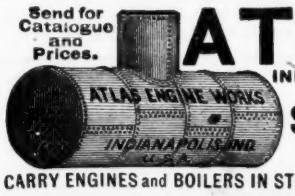

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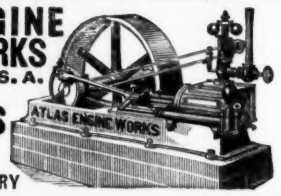

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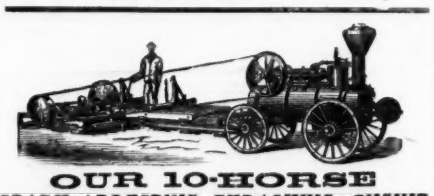

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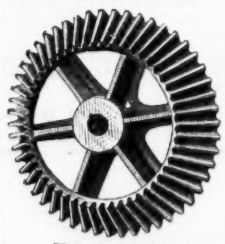

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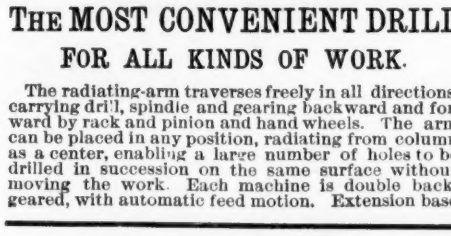

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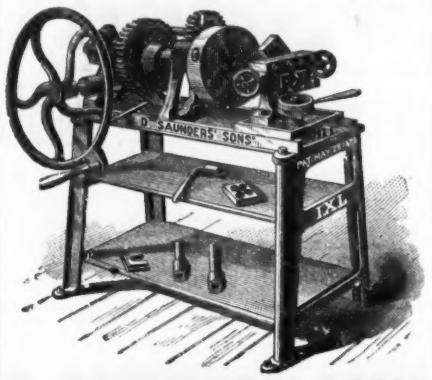

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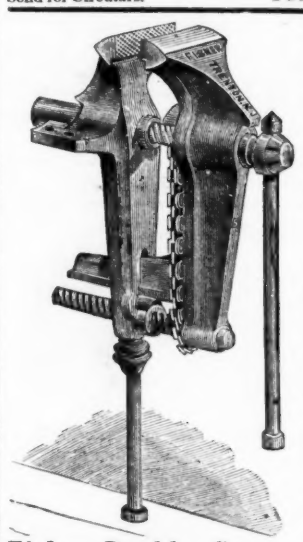

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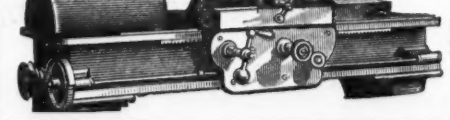

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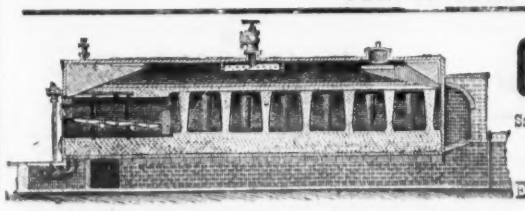

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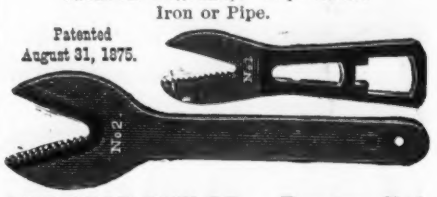

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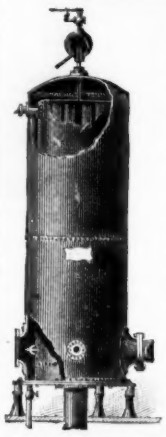

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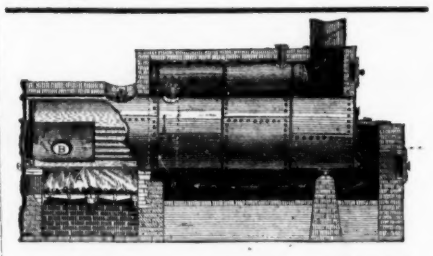

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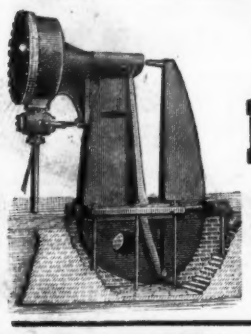

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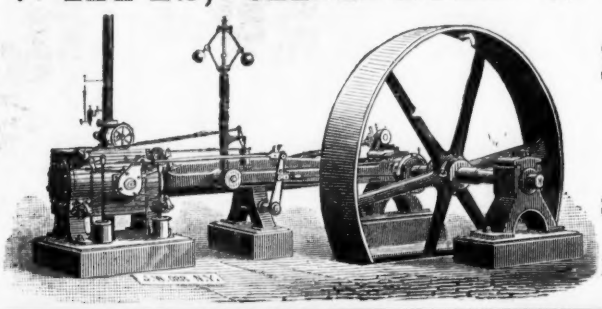

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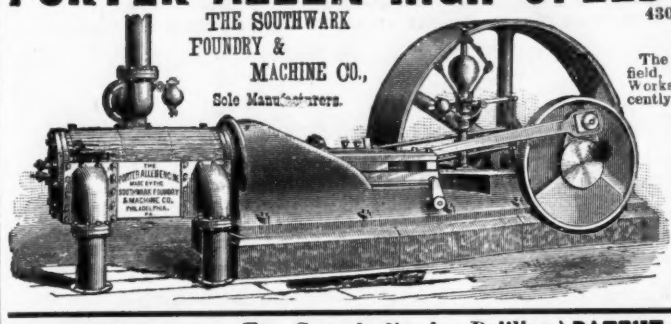

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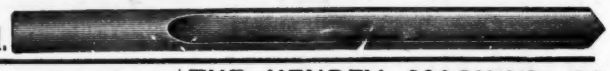

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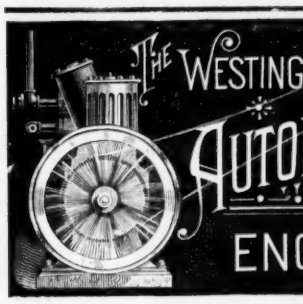

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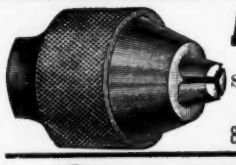

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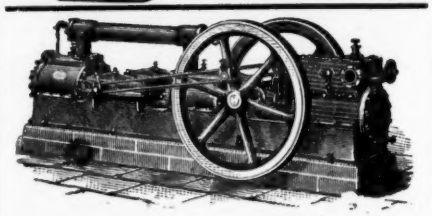

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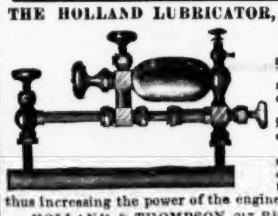

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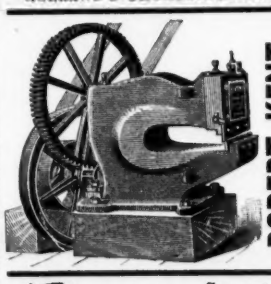

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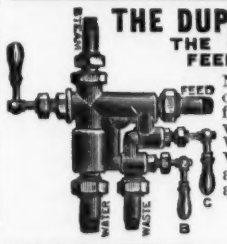

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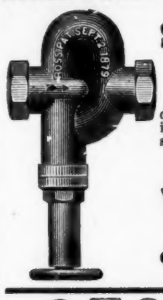

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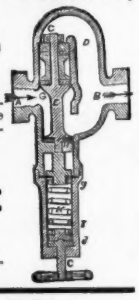

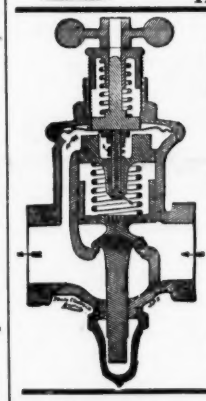

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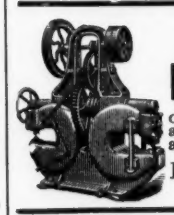

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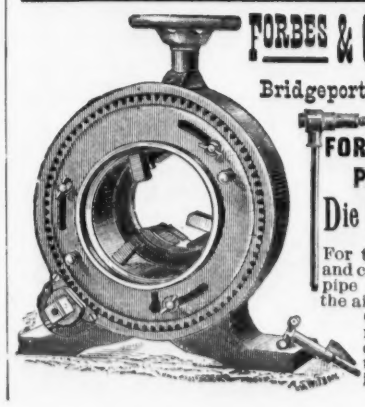

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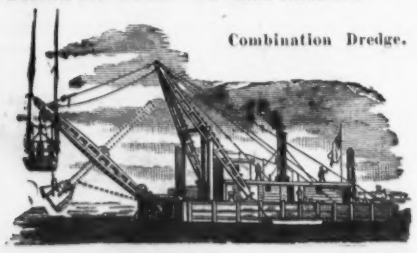

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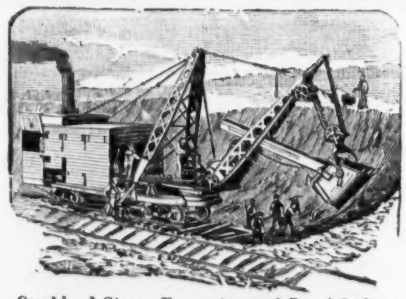

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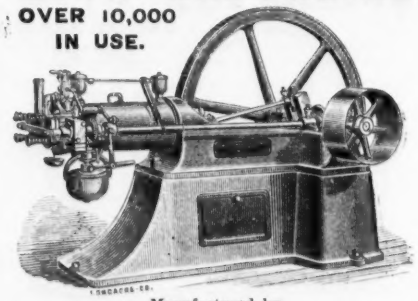

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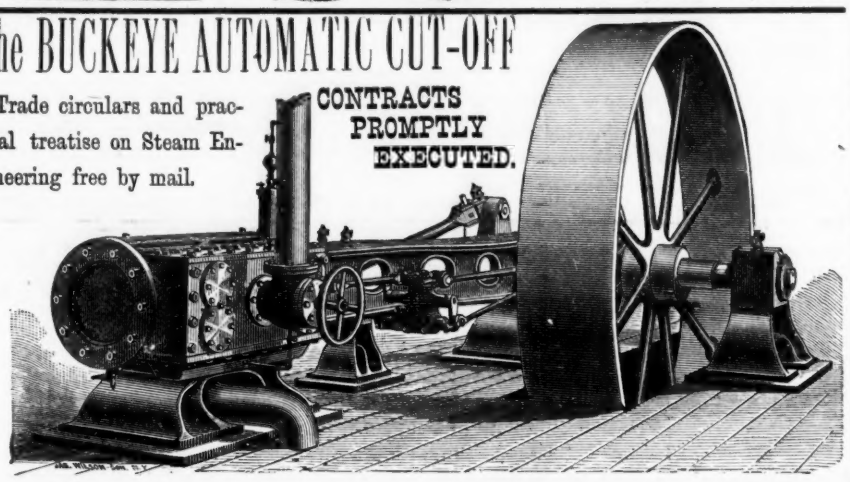

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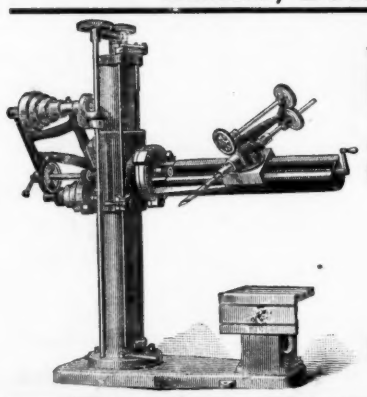

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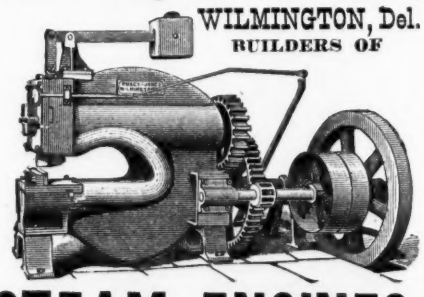

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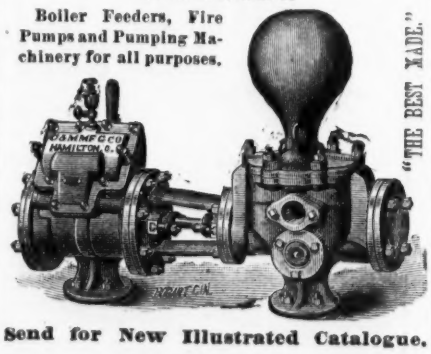

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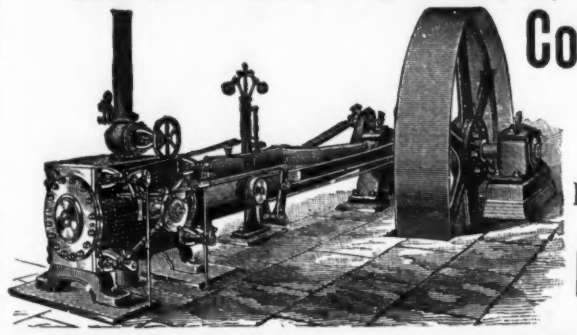

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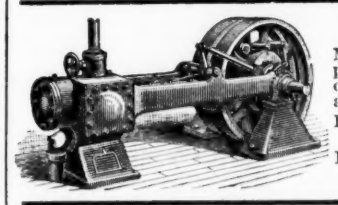

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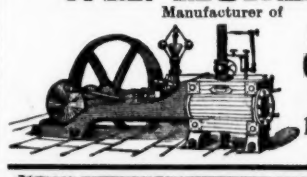

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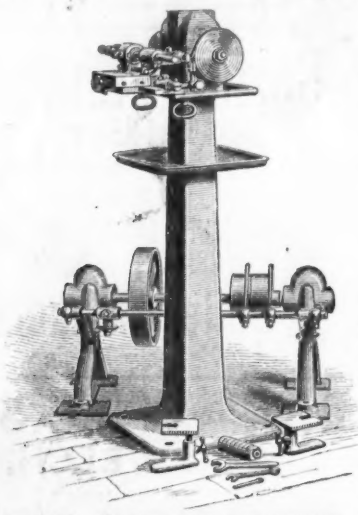

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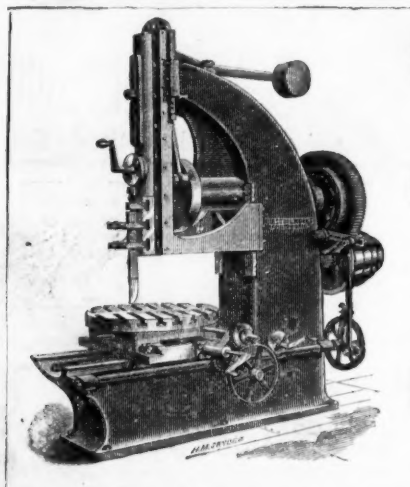

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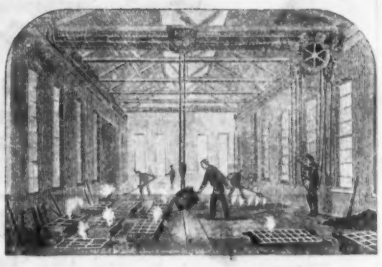

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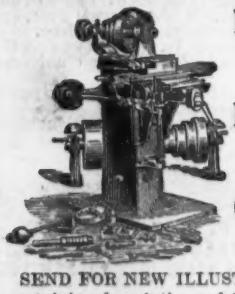

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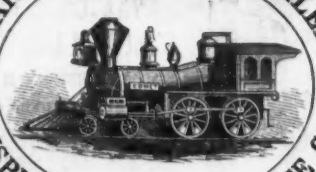

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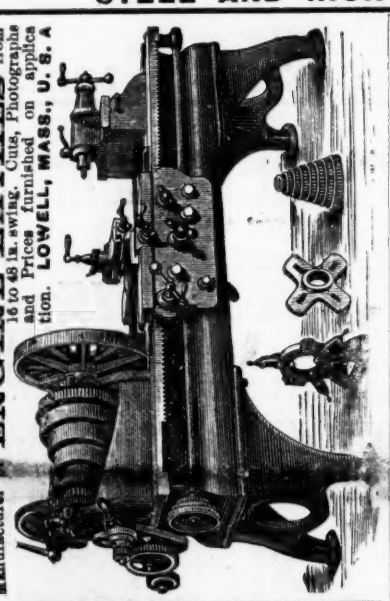

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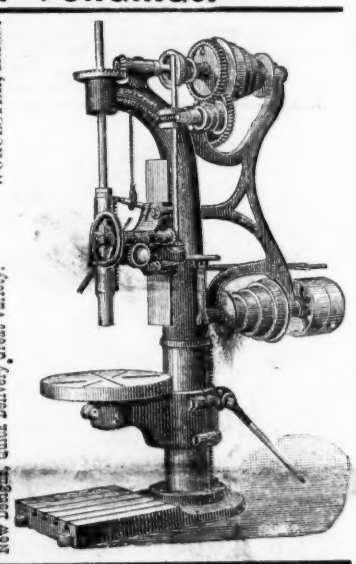

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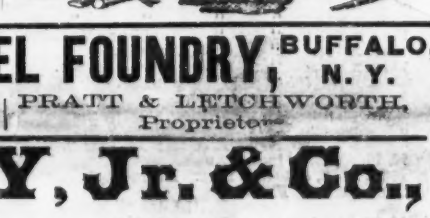

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